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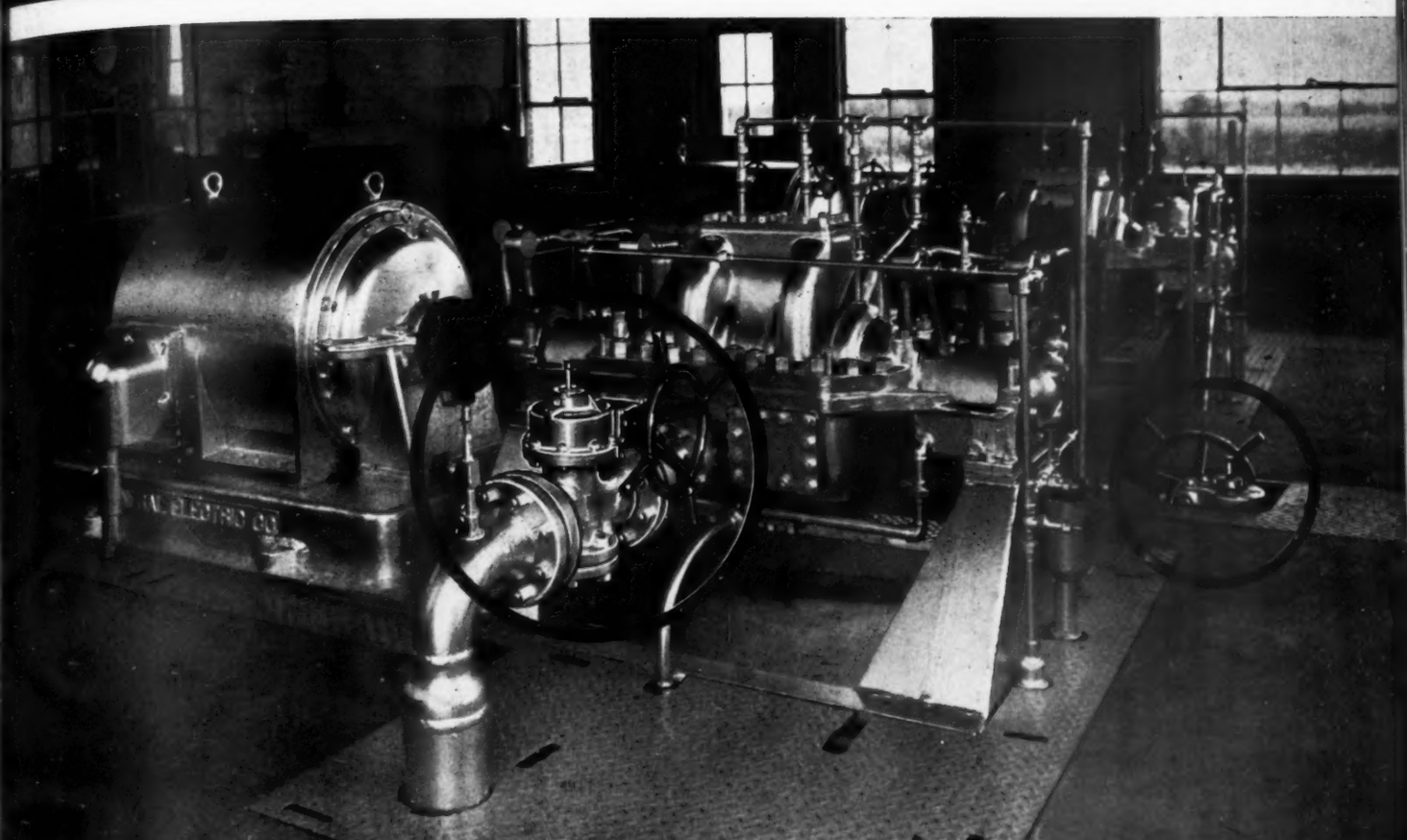

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Top—Streams cut oil, Eldorado field, 1917.

Bottom—Cut oil, Eldorado, Kans., oil field, 1917.

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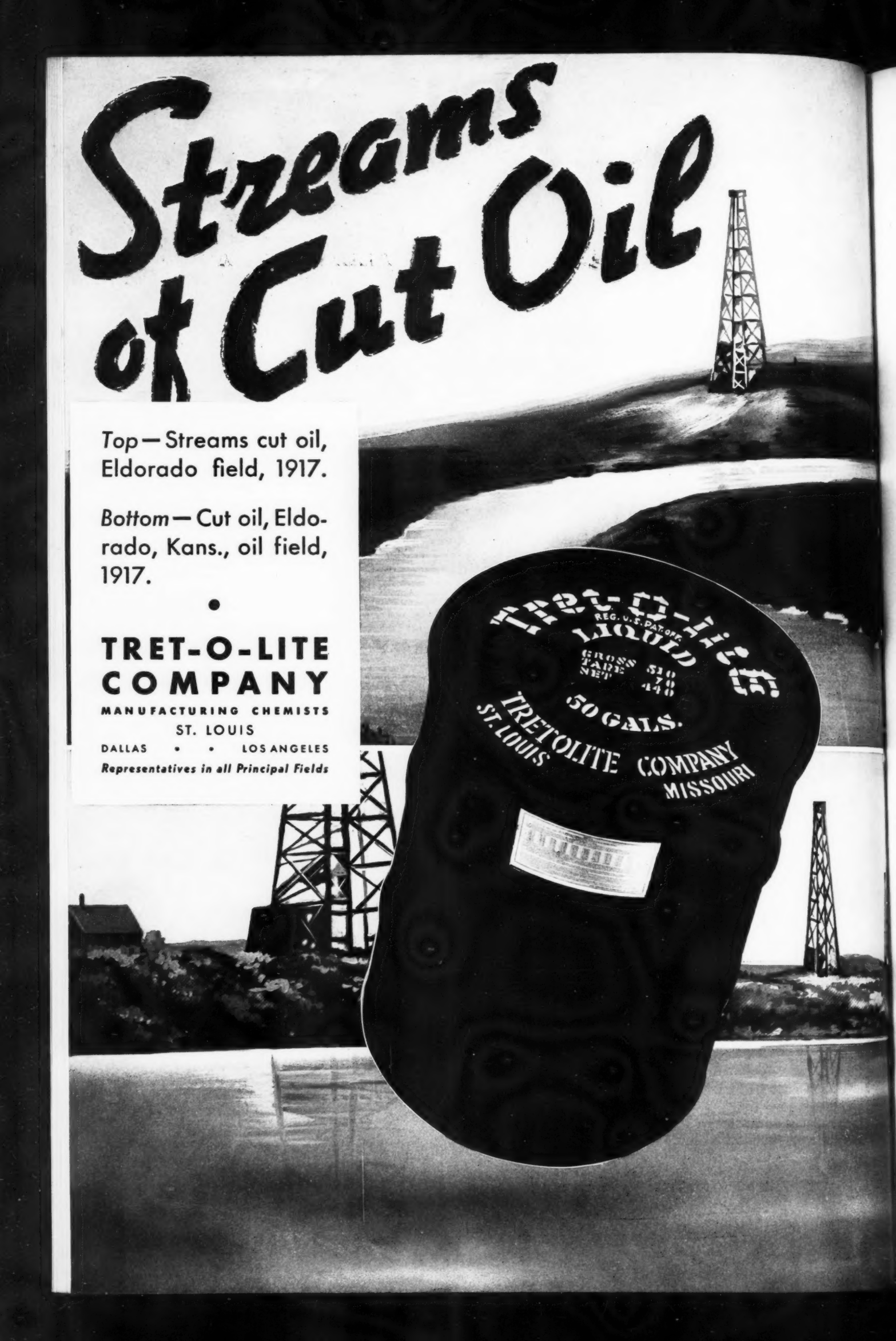

THE Petroleum Engineer

APRIL 1937 VOLUME VIII NUMBER 7

A MAGAZINE OF METHODS FOR OPERATING MEN

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Meetings

Western Petroleum Refiners' Association, 25th Annual Meeting—April 26, 27, and 28, Arlington Hotel, Hot Springs, Arkansas.

California Natural Gasoline Association—May 6, Richfield Building, Los Angeles, California.

American Petroleum Institute, Division of Production, Eastern District—May 6 and 7, Deshler-Wallick Hotel, Columbus, Ohio.

American Gas Association, Natural Gas Department—May 10, 11, 12, 13, 14, and 15, Kansas City, Missouri.

Natural Gasoline Association of America, Annual Convention—May 19, 20, and 21, Hotel Tulsa, Tulsa, Oklahoma.

National Oil Well Superintendents' Association — May 26, 27, and 28, Fort Worth, Texas.

American Petroleum Institute, Mid-Year Meeting—June 1, 2, and 3, Broadmoor Hotel, Colorado Springs, Colorado.

Pennsylvania Grade Crude Oil Association, Annual Meeting—June 10, 11, and 12, on Great Lakes Steamship "Seeandbee" sailing from Buffalo, New York.

American Gas Association, 19th Annual Meeting — September 27, 28, 29, 30, and October 1, Cleveland, Ohio.

Oil-World Exposition, Inc. — October 11, 12, 13, 14, 15, and 16, Houston, Texas.

Independent Petroleum Association of America, Annual Meeting—October 14, 15, and 16, Houston, Texas.

American Petroleum Institute, 18th Annual Meeting—November 9, 10, 11, and 12, Stevens Hotel, Chicago, Illinois.

International Petroleum Exposition—May 14, 15, 16, 17, 18, 19, 20, and 21, 1938, Tulsa, Oklahoma.

THE PETROLEUM ENGINEER PUBLISHING COMPANY

Seventh Floor Allen Building DALLAS, TEXAS

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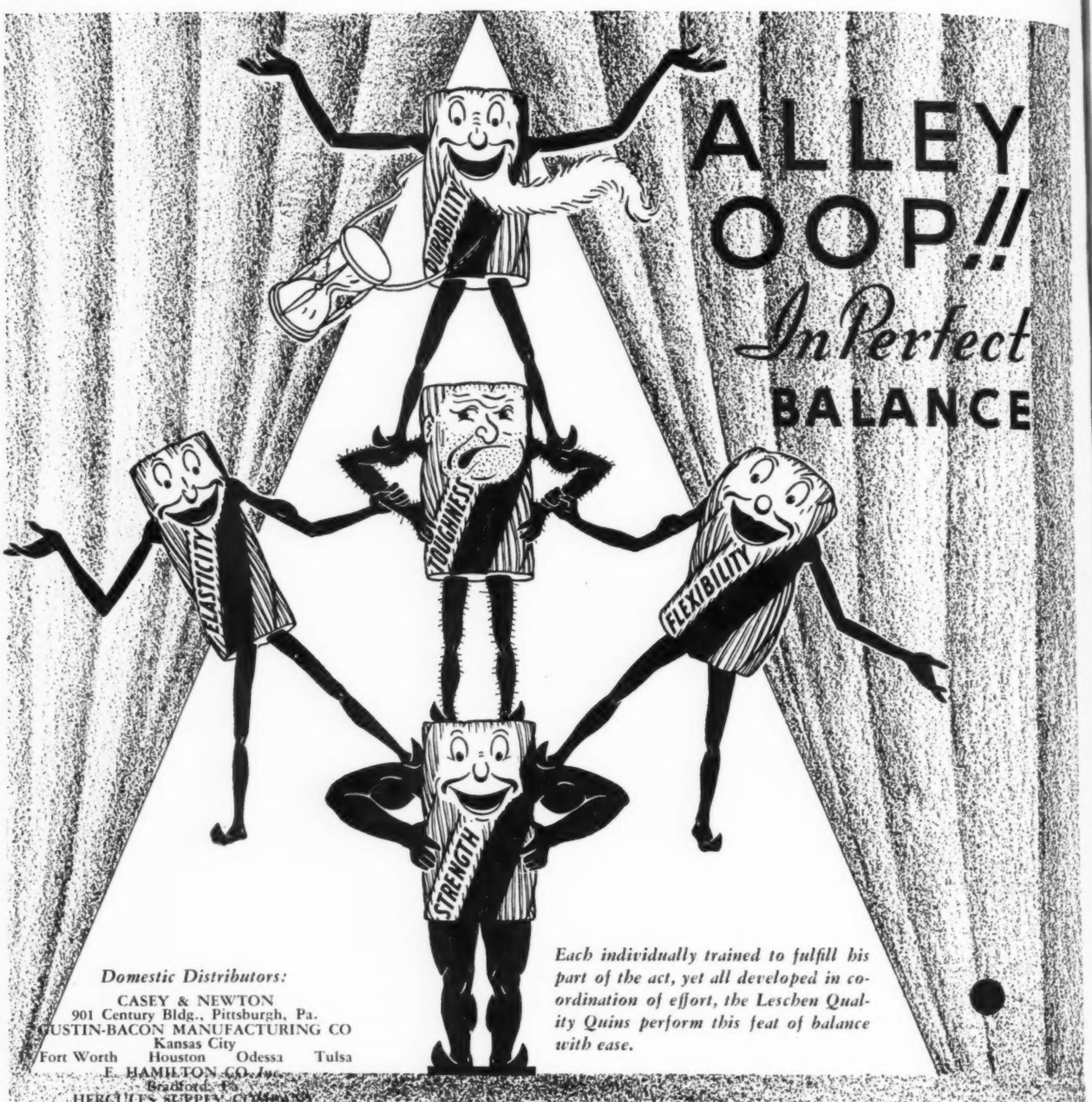

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The Course of Oil

By K. C. SCLATER

Oil-Finding Technique Inadequate Great progress has been made in recent years in oil-finding technique. Despite this progress, there is evidence that present technique is inadequate to cope with the increasing difficulty of oil-finding. Such was the information revealed recently in an enlightening discussion of discovery rates in oil-finding by Wallace E. Pratt before the A.A.P.G. at its annual meeting held in Los Angeles last month.

One of the perplexing problems of perennial discussion is that of estimating future additions to reserves through new discoveries. A study of past discoveries seems to be of little aid in making predictions of future discoveries. The element of gamble involved is too great. From time to time in the past the industry has been harassed by a plethora of new discoveries that brings in its wake ruinous crude prices. With no means at its disposal of controlling the supply to meet the demand the industry has been subject to recurrent periods of feast and famine. Thanks to the introduction of proration methods, orgies of overproduction may become a thing of the past; but the disquieting problem of maintaining an adequate rate of discovery remains and is one that must be faced. In a discussion of this problem, Pratt observes that, "A rough gauge of efficiency in oil-finding is the number of dry holes drilled per major discovery. Over the nation at large we have drilled about one thousand dry holes for each major oil field we have found up to the end of 1935. But in recent years this ratio has fallen markedly, until during the last five years it has averaged only 500 dry holes per major discovery."

"In discussions of the stability of the producing industry, the suggestion that we could well do with a smaller volume of oil in proven reserve is often advanced. Those who feel secure in our ability always to find more oil when we need it believe the present reserves to be excessive and burdensome. Considered merely as an inventory our reserves are undoubtedly heavy. No one likes to carry in stock all the raw material he expects to use over the next ten or fifteen years. But as a true reserve, to be drawn on only as we needed, our underground storage constitutes no burden, and is not too large.

"Another aspect of our reserves, apart from their adequacy as a supply for a certain number of years, has recently come to be realized. If oil is to be produced efficiently, that is, if recovery is to be reasonably complete and unit cost low, it must be produced at a rate slower than we have been accustomed to in the past. The optimum rate of production for a given pool depends, among other factors, upon the size of the reserve. The rate of production necessary to meet our national needs has risen to a point where our present reserves are barely large enough to permit efficient production at the required rate. This fact is coming to be recognized despite our current ability to produce, temporarily, in excess of market demand. Some of our production is simply maintained at a wastefully high rate. This consideration makes it desirable to maintain our reserves at something like their present volume even though we could do with smaller reserves, so far as other purposes are concerned. We need about our present reserve to permit efficient production at our present rate of consumption."

"Geophysics alone has not as yet been equal to the task of finding as much oil as all our older methods combined used to find. And so discovery rates have declined."

"The conclusion would seem to follow that if we are to maintain our established record in rate of discovery, or even to find oil at a rate equal to the current rate of consumption, we must further improve our finding technique in the near future."

Pools like East Texas of the shore-line type, whose accumulation of oil is dependent on stratigraphy rather than on structure, has brought new problems of oil-finding technique. In this connection, "Intensive studies in stratigraphy, sedimentary petrography, and paleontology, will become the working tools of this new technique. Such pools are often large, and, therefore, are worth finding, but it should be recognized that in the search for them the exploration must be carried out largely by the actual drilling of wells. Only the general locality can be indicated by the geologist or geophysicist, and within it the drill, through one test hole after another, must carry the exploration to completion."

"Our proven reserves, now about 13 billion barrels, are probably adequate or even excessive, viewed solely as a reserve supply, but they should be maintained at their present level to permit of production in an efficient manner and at the same time at the rate necessary to meet consumption."

"Our finding technique definitely needs to be strengthened. Merely finding structural traps at greater depths and drilling deeper wells to tap them, as we have been doing in recent years, promises too little to permit us to rely upon it alone. The most likely means of improving our oil-finding accomplishment is embodied in A. I. Leverson's suggestion, made a year ago, that we initiate an intensive search for 'stratigraphic traps.'

"This enterprise, if adopted, may be expected to cause an increase in the ratio of dry holes to discoveries," further, "it should accomplish its purpose; namely, the discovery of important additional reserves of petroleum."

Removal of this inadequacy in oil-finding technique would enable the industry to look to the future in the matter of discovering additional reserves with more equanimity than it does at present.

« « HIGHLIGHTS IN OILDOM » »

Wilmington Most Active Area in California

The Wilmington area in Los Angeles County at present is the most active area in California. At latest reports this field had more than 20 producing wells, 22 drilling wells, five ready to be spudded in, 15 rigs up, and 29 locations staked.

While approximately 20 companies and operators are interested in the area those having the greatest number of operations are the Union Pacific Railway Company, General Petroleum Corporation, which drilled the discovery well, A. T. Jergins, and Royalty Service Corporation.

For the most part the wells are being completed at depths from 3500 ft. to 4000 feet. Usual practice calls for the setting of a 20-in. surface pipe at from 80 to 100 ft., and 8⅝-in. casing at approximately 3500 feet. In some instances strings of 11¾-in. and 13⅜-in. casing have been set at 2500 feet. The oil produced is heavy, from 17 to 18 deg. A.P.I.

●

More Gasoline Being Produced in Italy

A report from Rome, Italy, says the number of licenses for the import of gasoline has been greatly reduced by the Interministerial Board of Petroleum Control. This reduction in imports is consistent with the changing national petroleum situation resulting from a growing refining industry.

Production of gasoline in 1937 will reach a total of 2,337,500 bbl., it is estimated. There is, moreover, the production of fuel alcohol to be considered, which this year must be mixed with gasoline to the extent of 20 percent.

During 1936 import licenses were granted for 4,505,000 bbl. of gasoline and 1,533,000 bbl. of crude oil. Although the exact license figures for the current year are not yet known, it is believed the quantity of gasoline to be imported will be reduced by 700,000 bbl. and crude oil by 425,000 barrels.

●

"Changed Conditions" Interpreted by Texas Commission

The Texas Railroad Commission in a new order, has clarified its interpretation of Rule 37 pertaining to well spacing by explaining what it means by "changed conditions" in making exceptions to the rule. Under certain circumstances an application to drill may be granted even though previously the same application was denied. The "changed conditions" that make this possible are enumerated by the commission as follows:

1. Any material changes in the physical conditions of the producing reservoir or under the area surrounding the said tract that would affect the recovery of oil.

2. Any material changes in the distribution or allocation of allowable production in the area surrounding the tract under consideration that would affect the recovery of oil from the given tract.

3. Any additional permits granted by the commission or wells drilled in the area surrounding or on offset tracts.

4. Any additional facts or evidence thereof materially affecting or tending to affect the recovery of oil from applicant's tract, or the property rights of applicant, that were not known to and considered by the commission at any previous hearing of application thereon.

●

Estimate Bradford Area Good for 15 More Years

In a recent report made by engineers of the Tide Water Oil Company it was estimated that the Bradford area will continue to produce crude oil profitably for another 15 years at least. At the end of that period, it was said, approximately 350,000 bbl. of oil will remain to be recovered by mining or some other method that may be devised.

Last year 3750 acres of oil land were depleted in the area, the report said.

During 1936 new wells drilled increased 48 percent over the previous year. Producing wells at the beginning of this year were: Pennsylvania, 80,500; New York, 14,650; West Virginia, 13,600; and Ohio, 12,450.

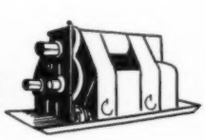
●

Approve Making Permanent Connally Oil Act

The United States Senate has approved, following an unanimous recommendation by the Finance Committee, the passage of the Connally bill making permanent the Connally "hot oil" act, due to expire June 16th. The Connally act, passed February 22, 1935, provides that oil and oil products produced in excess of the amounts permitted by state law is contraband and may not be moved in interstate and foreign commerce. Five states have laws regulating oil production. These states—Kansas, Louisiana, New Mexico, Oklahoma, and Texas—produce 73 percent of the national crude oil output.

In discussing the advisibility of making the act permanent the report said in part:

"During the fiscal year ending June 30, 1936, the Department of Interior in administering the act of February 22, 1935, issued about 6,000 certificates of clearance involving 222,000,000 bbl. of petroleum and petroleum products at a cost of about one-tenth of a cent a barrel. If the act is terminated on June 16, 1937, contraband oil will frustrate the states in their conservational activities with resultant waste of an irreplaceable natural resource essential to the prosperity of our citizens and absolutely indespensable to our national defense. An example of the effectiveness of the act from the standpoint of conservation by the prevention of waste is established by testimony that through the coöperative efforts of state and federal governments the ultimate recovery of oil in one field has been increased by more than 600,000,000 bbl., an amount that could be equaled only by the discovery of 60 average-sized oil fields. As stated, the act supports state oil and gas conservation laws and increases their effectiveness."

American Roller Bearings *dominate* in the oil fields the most difficult service a bearing could seek. They are *specialized* bearings—built only for heavy-duty service —designed to stand up under the tremendous loads strains and impacts of oil-field service. They carry TONS where other bearings carry pounds. Little wonder, then, that 30 manufacturers of heavy-duty drilling equipment  use them as *standard.*

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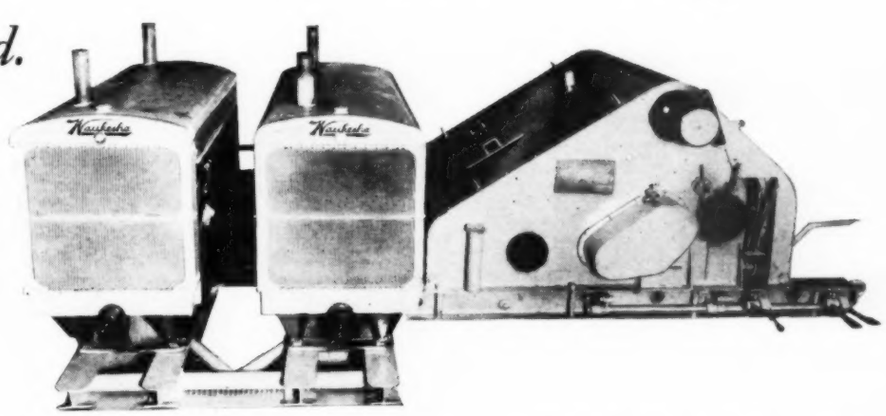

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Progress of Major Pipe Line Work

THE Texas-Empire Pipe Line Company has announced additions to its system that will increase the capacity from 78,000 bbl. daily to 84,000 barrels. Standby pumping units will be installed in main line stations at Sheldon, Lowry City, Pisgah, Center, and Virginia, in Missouri, and at Heyworth and Fairbury in Illinois. The program also calls for an additional pumping unit at Mattoon on the Lawrenceville 8-in. lateral, and a unit at El Dorado on the Kansas 10-in. lateral, 6.38 miles of 12-in. loop between Heyworth and Fairbury, 1.39 miles of 12-in. loop between Fairbury and Wilmington, and 17.56 miles of 10-in. loop between Manhattan Junction and Lockport. Plans also are under way for increasing the capacity of the Kansas 10-in. lateral by intermediate pumping. This expansion program will involve an expenditure of $850,000 within the next few months.

The addition of standby units at the pumping stations assures a full time maximum pumping rate, and the elimination of shut down time for repairs and overhauling accounts for the increase of 6000 bbl. daily. Of the new units, four will be pumps of 30,000 bbl. daily capacity, Diesel driven, and one with 35,000 bbl. daily capacity. The other pumps will be of smaller capacity, some being driven by electric motors, others by Diesel engines.

Construction will be done by the Texas-Empire personnel under the supervision of F. A. Stivers, general superintendent.

●

Construction began March 15 on the Cities Service Gas Company's 47-mile 12-in. extension from the south end of the company's Seminole, Oklahoma, 16-in. line to the Carter Oil Company's gasoline plant in the Fitts field. The extension is being laid to supply the Kansas City Gas Company, a Cities Service subsidiary, with additional gas to fill a large industrial contract.

Bert Milam, superintendent of pipe lines for the Cities Service Gas Company, is supervising the work. Harry McDaniels is the resident superintendent.

●

The Trans-Pecos Pipe Line Company is constructing a 33-mile trunk line from the Maljamar and other fields in southeastern New Mexico to the Lynch station in Texas, it has been announced. F. A. Hornaday, of San Antonio, Texas, is president of the company and made the announcement. The line will tie into the trunk line of The Texas Pipe Line Company at Lynch station, which will transport the crude oil on to Gulf Coast terminals. The destination of the crude will be a new refinery at Trieste, Italy.

●

The Standish Pipe Line Company, subsidiary of the Phillips Petroleum Company, will increase the capacity of its Western Kansas crude oil pipe line system from 17,000 to 25,000 bbl. daily, officials of the company have announced. A total of 93 miles of main line will be looped and additional equipment installed.

●

The Barnsdall Pipe Line Company has awarded to Williams Brothers Corporation the contract for laying a 76-mile 6-in. oil line from the Placedo field of South Texas to a refinery to be constructed near Corpus Christi by the Barnsdall Refining Company. The line will be oxy-acetylene-welded by the Lindeweld method.

●

The right-of-way is being surveyed for a 6-in. pipe line to be laid by the Shell Petroleum Corporation from their Barnsley station between Winkler and McCamey, Texas, north to the Cummins area of the Goldsmith pool, a distance of 48 miles. The route of the line will be through the Penwell and Harper pools in southern Ector County. It is expected to be completed by May 10th.

●

The Texas-New Mexico Pipe Line Company has been formed by The Texas Company, Sinclair, Tide Water, and Empire, and has taken over the operation of The Texas Pipe Line Company's West Texas pipe line. Eleven new pipe line stations will be constructed, increasing the capacity of the line from 31,000 bbl. daily to 60,000 bbl. daily. During the next two years the capacity of the line may be increased to 90,000 bbl. daily, it is announced.

●

The El Paso Natural Gas Company is laying three important laterals, principally to supply natural gas to copper refineries. One is an 8½-mile 6-in. line to Hurley, New Mexico, from an existing 5-in. line near White Water. Another is a 21-mile 4-in. line from the company's 12-in. trunk line near Lordsburg, New Mexico, to supply domestic gas in Lordsburg. The third line is a 46-mile 6-in. lateral from the 10-in. trunk line near Red Rock, Arizona, to Hayden, Arizona. The lines are being oxy-acetylene-welded by the Lindeweld method.

●

Details of its construction program, planned for this year, have been made known by the Panhandle Eastern Pipe Line Company. The existing line will be looped, capacity of nine compressor stations will be increased, a new station will be erected at Tuscola, Illinois, four river crossings made, absorption and dehydrating equipment added at the natural gasoline plant at the Liberal, Kansas, station, new gas wells drilled in the Hugoton, Kansas, field, and extensions made to the gathering system. A total of 227 miles of 24-in. pipe will be laid and 24 miles of 22-inch. The 24-in. pipe will be laid on the discharge side of the stations at Liberal, Greensburg, Haven, Olpe, and Louisburg, Kansas; and Houstonia, Missouri. The 22-in. will be laid out of the Centralia, Missouri, and Pleasant Hill, Illinois, stations.

Additions to compressor stations include: three 1000-hp. engines at Liberal; three 1300-hp. engines at Greensburg; three 1300-hp. engines at Haven; three 1300-hp. engines at Olpe; two 1000-hp. engines at Louisburg; one 1300-hp. engine an Houstonia; two 1300-hp. engines at Centralia; three 1300-hp. engines at Pleasant Hill; and one 1000-hp. engine at Glenarm. The new station at Tuscola will have three 1300-hp. engines.

The National Tube Company and the A. O. Smith Corporation were given orders for the pipe, with delivery to begin about May 1st.

●

Construction will begin immediately on a 37-mile pipe line extension in Kansas and erection of a power plant at Moundridge, Kansas, it is announced by the Continental Oil Company. The new 8-in. pipe line will extend from the Geneseo pool in Rice County to the Ainsworth pool near Stickney.

Capacity of the Moundridge gas-electric plant will be 800 kw., generated by three 400-hp. gas engines. The new unit will provide power for Continental's pipe line, production, and drilling operations in the Graber pool.

Another project announced by company officials is the proposal to increase the capacity of a gasoline plant and booster station recently purchased by Continental near Britton, Oklahoma.

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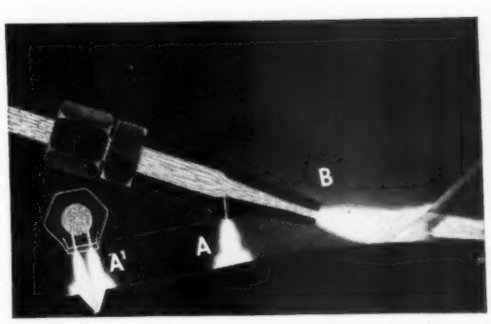

A schematic cross section shows the Multi-Flame Lindewelding Head in action. The small flames, A, preheat the pipe while the main flame, B, melts the welding rod and postheats the weld. A' is a cross section view through the preheating flames, A.

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Latest Activities In The Oil Fields

ARKANSAS oil men are contemplating with considerable satisfaction the possibility of a new boom in the state as a result of the Lion Oil Refining Company's discovery in Union County. The field opener, No. 1 Morgan, is 15 miles southwest of El Dorado and eight miles north of the Louisiana line. The well was completed at a total depth of 5559 ft., beginning to flow after a swab was run four times. Production is from either the lower Travis peak or upper Permian. The oil is 40.3 gravity.

●

The Lisbon (Glen Rose) lime pool, Claiborne Parish, North Louisiana, discovered last December was given its fourth producer early this month when the Red Iron Drilling Company completed its No. 1 H. E. Patton and extended the pool one-half mile to the north. The total depth of the new well is 5312 ft., to which depth it was plugged back from 5340 feet. Many are viewing the Lisbon pool as the most important North Louisiana discovery since Rodessa.

●

Hockley County, in the northern extremity of the West Texas (Permian Basin) field, has had its first oil production as a result of the successful completion of The Texas Company's test, No. 1 Bob Slaughter. The well, whose total depth is 5022 ft., made an estimated 100 bbl. in six heads during a period of six and one-half hours, the crude being 31.9 deg., corrected.

●

A new field has been opened in the Newhall-Saugus area, Los Angeles Basin, California, by the Barnsdall Oil Company with their No. 1 Rancho San Francisco. At a total depth of 6472 ft. the well flowed 350 bbl. of 36.2 gravity oil. Production is coming from formations of Miocene age.

●

One of the most interesting tests drilling in the eastern fields is that of William Snee and others on the Summit Hotel lease on Chestnut Ridge, south Union Township, Fayette County, Pennsylvania. The test is a side-track job from a hole drilled previously to a depth of 6611 ft. where gas volume in excess of 500,000 cu. ft. was found, but it was impossible to run casing in the crooked hole. Sidetracked at 4250 ft., the hole now has reached a depth of 6645 feet. The test is of importance because of the fact that it is on a large structure miles distant from any producing gas well. It also is farther east than any of the lower gas fields producing from the Devonian series.

●

Four new pools have been opened recently in Kansas, in Reno, Greenwood, Ellis, and Butler counties. Northwest of Hays, Ellis County, Lario Oil and Gas Company discovered a pool with their well No. 1 Cress at a depth of 3302 feet. Well No. 1 McCaig of A. M. Landon, former governor, is the discovery well in Butler County. The total depth of the well, which is eight miles east and 15 miles south of Eldorado, is 2739 feet. The Reno County discovery was by Clyde Pulse et al with their No. 1 Payne. This well is almost on the northern boundary line of the county and is producing from a total depth of 3244 feet. Ten miles north of Eureka, Greenwood County, Ohio Oil Company successfully completed their No. 1 Schwab at 2700 feet. Production is from the Siliceous lime.

●

Helmerich and Payne et al's No. 1 Graham, in the South Doyle pool, ten miles northeast of Duncan, Oklahoma, has opened a new gas area. Abandoned as a dry hole at a depth of 5014 ft., the test cleaned itself and blew in wild, producing an estimated 25,000,000 cu. ft. of gas daily with a showing of heavy oil. This is the deepest test ever drilled in the Doyle area.

●

On the intial 24-hour test Royalite Oil Company's No. 4 Sterling Pacific produced 1350 bbl. of crude oil, later settling to between 1200 and 1300 barrels. This is the largest producing well in the South Turner Valley field of Alberta, Canada. The total depth of the well is 7184 ft., and is 468 ft. in limestone formation.

AVERAGE CRUDE PRICES

California	
Kettleman Hills	$1.19-1.43
Playa Del Rey	.80-1.16
Coalinga	.70-.90
Signal Hill	.80-1.21
Montana	1.35
Wyoming	.97-1.30
Colorado	1.12-1.18
New Mexico	.78-1.08
Texas	
North Central	.96-1.20
Panhandle	.91-1.08
West Texas	.78-1.08
Gulf Coast	.95-1.41
Darst Creek	1.09
East Texas	1.27
Talco	.73
Kansas	.98-1.30
Oklahoma	.98-1.30
Arkansas	.90
Louisiana	
Rodessa	$ .93-1.25
Gulf Coast	.84-1.41
North Louisiana	.90-1.22
Illinois	1.35
Kentucky	1.40
Indiana	1.12
Ohio	
Lima	1.25
Michigan	1.42
Pennsylvania	
Bradford	2.67
Southwest	2.42
Eureka	2.37
Buckeye	2.22
Corning	1.32
West Virginia	1.67
Canada	2.10-2.17

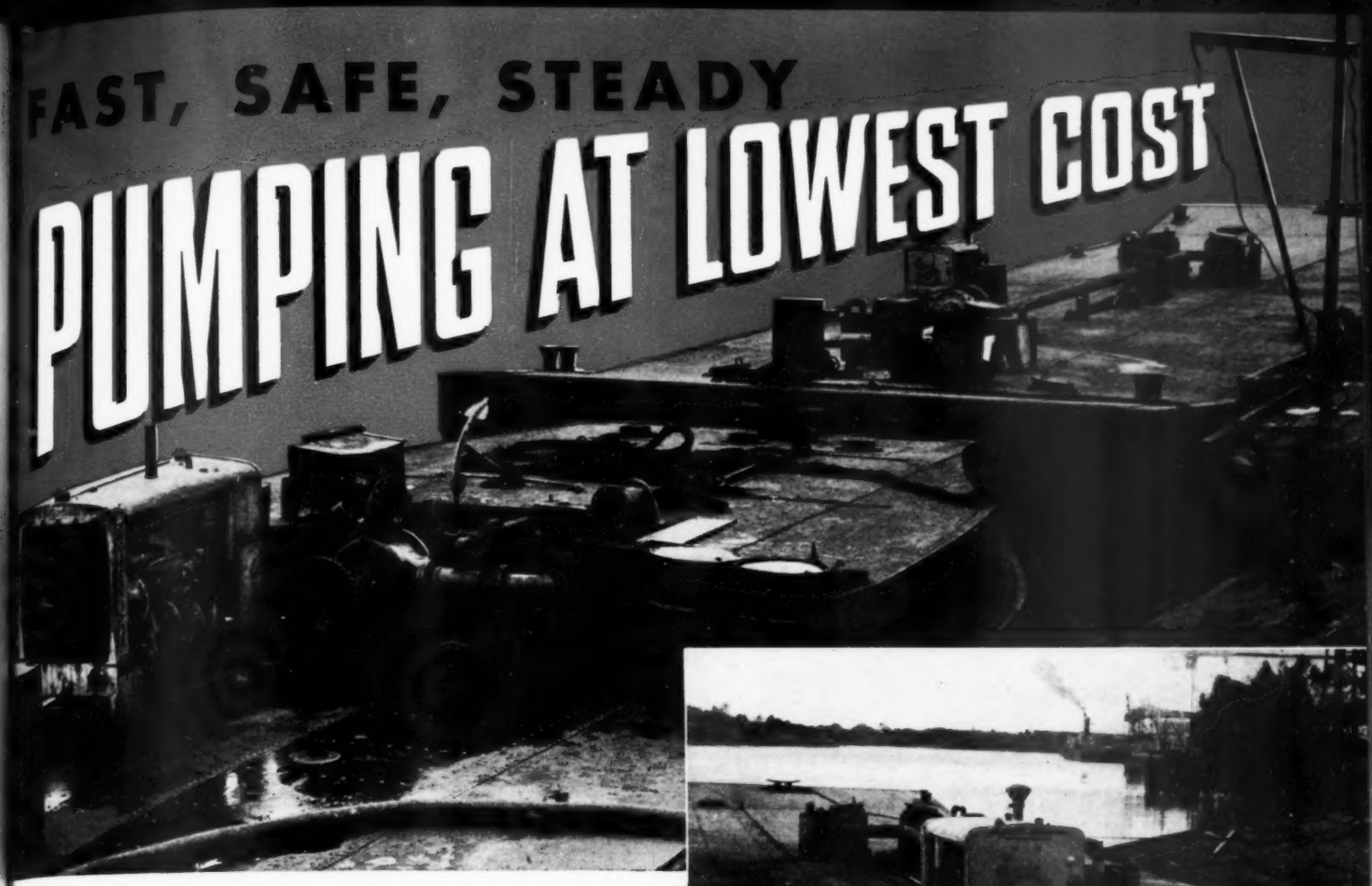
DAILY AVERAGE CRUDE OIL PRODUCTION

Data Supplied by A.P.I.

(Figures in Barrels)

	B. of M. Dept. of Int. Calculations (April)	Week Ended Apri. 3, 1937	Week Ended Feb. 27, 1937	Week Ended Apr. 4, 1936
Oklahoma	609,600	648,700	603,000	527,400
Kansas	183,000	189,200	183,200	151,800
Panhandle Texas	.....	75,250	75,900	60,650
North Texas	.....	68,300	66,950	58,100
West Central Texas	.....	33,150	31,900	25,050
West Texas	.....	208,300	190,300	177,200
East Central Texas	.....	123,450	107,700	48,100
East Texas	.....	455,750	452,050	443,750
Southwest Texas	.....	224,350	218,100	133,300
Coastal Texas	.....	208,750	194,450	177,750
TOTAL TEXAS	1,297,900	1,397,300	1,337,350	1,123,900
North Louisiana	.....	71,650	69,700	72,000
Coastal Louisiana	.....	174,400	173,400	140,450
TOTAL LOUISIANA	244,800	246,050	243,100	212,450
Arkansas	27,400	27,450	27,500	29,950
Eastern	115,000	116,000	117,550	108,850
Michigan	30,600	40,100	33,100	38,950
Wyoming	44,000	49,000	52,250	35,350
Montana	14,600	14,800	15,550	12,850
Colorado	4,800	4,200	4,450	4,850
New Mexico	91,400	102,950	97,350	63,750
TOTAL EAST OF CALIF.	2,663,100	2,835,750	2,714,000	2,310,100
California	579,900	586,600	581,700	563,800
TOTAL U. S.	3,243,000	3,422,350	3,296,100	2,873,900

FAST, SAFE, STEADY
PUMPING AT LOWEST COST



This 44-hp., installed on Eggers barge E334 for transporting gasoline in bulk, drives a 4-inch centrifugal pump. Fuel consumption, 2 gallons per hour.

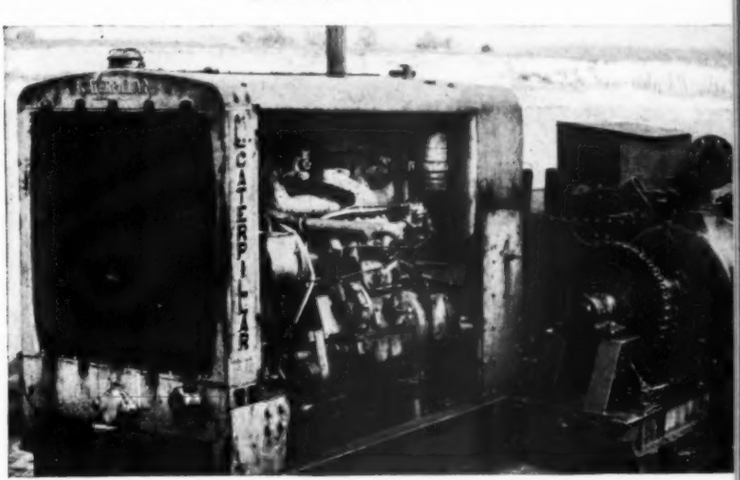
INSTALLED on the oil barges of Ernest Eggers, Houston, Texas, two "Caterpillar" Diesel Engines are making records for dependable, low-cost unloading power.

Driving centrifugal pumps at a discharge rate of 800 to 900 barrels per hour, each of these engines has a fuel-and-lubrication cost that averages *less than 10 cents an hour.*

Daily it is becoming more and more apparent that no other form of industrial power is as economical as Diesel . . . and that no other Diesel engines are more efficient and dependable than those made by "Caterpillar."

With their advanced engineering, these modern oil-fueled engines mean rock-bottom operating, maintenance and depreciation costs. Mr. Eggers has capitalized on these advantages. In addition to the two barges, he owns the tugboat "Fannie D" which is propelled by a "Caterpillar" Diesel Marine unit.

Complete information is obtainable from the nearest dealer or direct from us. *Seven engine sizes—44 to 160 horsepower.*



This 47-hp., on one of the Eggers barges, drives a 4-inch centrifugal pump discharging bunker C crude. Fuel consumption, 2½ gallons per hour.

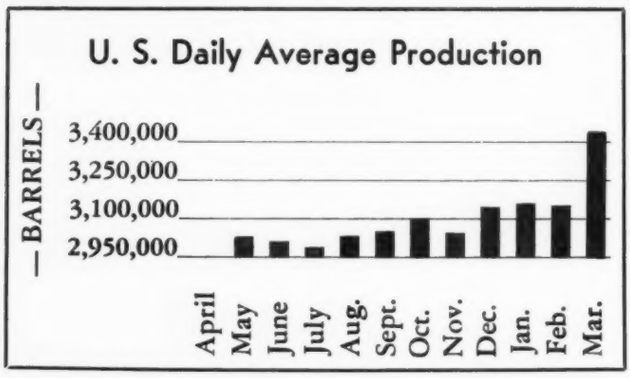
CATERPILLAR DIESEL ENGINES

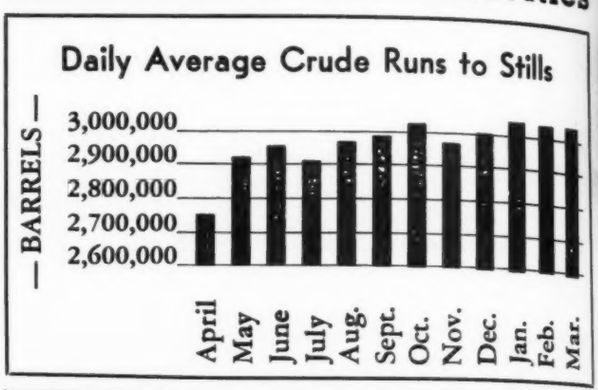
REG. U.S. PAT. OFF.

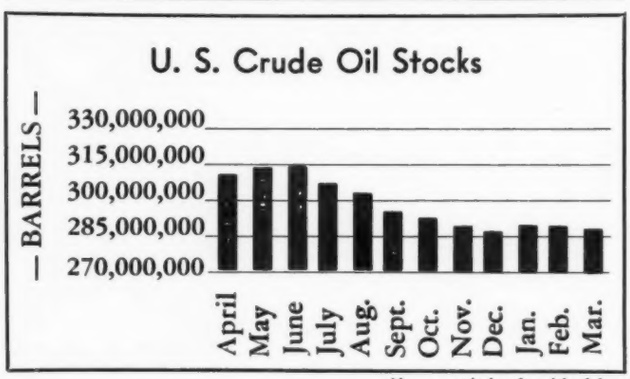
CATERPILLAR TRACTOR CO., PEORIA, ILLINOIS

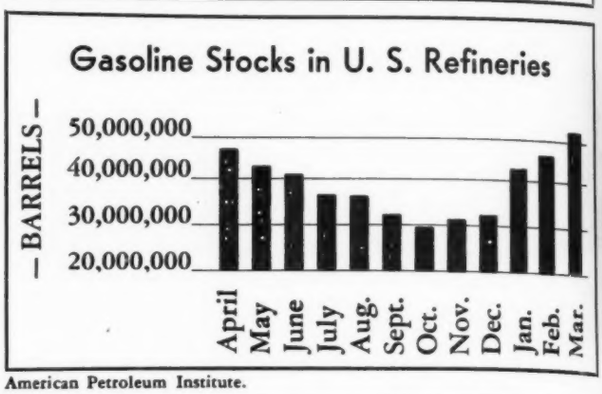
WORLD'S LARGEST MANUFACTURER OF DIESEL ENGINES

Summary of Petroleum Statistics and Field Activities









Above statistics furnished by the American Petroleum Institute.

Summarized Operations in Active Fields for March, 1937

Fields	Completions	Producers	Rigs	Drilling Wells	Depth of Production	No. Casing Strings	Gravity of Oil	Type of Tool Used
Texas								
East Texas	193	185	69	92	3500-3700	2	40	Rotary
Duval County	83	67	20	53	1554-2900	2	22	Rotary
Archer County	41	16	2	14	660-1800	1 or 2	40	Rot.-Cab.
Panhandle	60	57	42	107	1700-3900	2	40	Rotary
Refugio	19	18	3	14	4900-5900	2	38	Rotary
Nueces County	61	45	25	60	3922-5878	2 or 3	21-54	Rotary
San Patricio County	10	8	3	11	3987-6141	2	23-65	Rotary
Talco Field	31	30	16	45	4230-4361	2	16-24	Rotary
Oklahoma								
Oklahoma City	14	13	3	20	6450-6682	3	39	Rotary
Fitts Pool	42	39	7	56	1800-4488	2 or 3	38	Rotary
Osage County	25	12	2	26	380-2850	2	37.5-40	Rot.-Cab.
Kansas								
McPherson County	8	6	2	12	2900-4300	2	38	Rot.-Cab.
Russell County	41	37	6	57	2926-3435	2 and 5	32-37	Rot.-Cab.
Rice County	38	34	11	61	3222-4085	2 and 5	42-48	Rot.-Cab.
Reno County	20	16	5	34	3300-4375	2 and 5	42-48	Rot.-Cab.
Louisiana-Texas								
Rodessa	40	40	10	61	5950-6450	3	39	Rotary
New Mexico								
Lea County	76	76	21	97	3150-4030	3	30-34	Rot.-Cab.
California								
Kettleman Hills	2	2	2	13	8300-8730	3 or 4	40	Rotary
Wilmington	16	16	15	23	3500-4000	2 and 3	18-20	Rotary
Midway-Sunset	16	16	15	25	1400-3100	1 and 2	11-30	Rot.-Cab.

Field Activities by States for March, 1937

State	Completions		Producers		Locations		Rigs		Drilling Wells		Production, 1936 (In Barrels)
	March	February	March	February	March	February	March	February	March	February	
Arkansas	8	11	2	3	26	12	16	8	47	26	10,461,000
California	90	94	79	59	122	96	110	75	271	229	214,883,000
Colorado	3	2	1	2	....	....	3	2	25	23	1,670,000
Illinois	6	1	6	1	....	....	39*	33	8	10	4,452,000
Indiana	7	6	5	4	....	....	6	5	29	25	795,000
Kansas	182	139	146	108	191	164	75	50	367	363	58,226,000
Kentucky	11	5	9	4	....	....	13	15	46	45	5,653,000
Louisiana	71	61	44	38	82	56	32	29	195	201	79,980,000
Michigan	57	53	37	35	77	63	78	77	144	146	11,852,000
Mississippi	....	....	....	....	....	....	2	3	8	9	Gas Prod.
Montana	3	4	3	4	....	....	3	4	45	43	5,632,000
New Mexico	69	47	69	42	....	....	15	17	111	120	27,134,000
New York	....	....	....	....	....	....	9	8	49	22	4,637,000
Ohio	155	63	108	43	....	....	73	71	260	251	3,834,000
Oklahoma	232	192	174	142	243	190	63	58	494	449	206,082,000
Pennsylvania	....	....	....	....	....	....	....	....	....	....	15,830,000
Texas	1176	942	929	777	1746	1037	453	442	1521	1503	391,097,000
West Virginia	77	64	67	55	....	....	28	30	168	172	3,903,000
Wyoming	12	5	5	5	....	....	2	3	48	42	13,650,000
Total	2159	1689	1684	1322	2487	1630	1020	959	3836	3823	993,942,000

*Includes seven operations rigging up, 27 temporarily shut down, and five inactive.

The historic McMann ferry that plied the Cimarron River, two and a half miles south of the present town of Oilton, Oklahoma. Across this ferry between 1912 and 1915, were transported tons of equipment used in the development of the famous Cushing and Oilton fields. . . . The old ferry was the only safe method of crossing due to the Cimarron's current and treacherous quicksand bottom.

Oklahomans, proud of their state's dominant position in American oil production, can well give a big vote of thanks to the discoverers and developers of Oilton and Cushing. . . . Credit where credit is due is always gratifying. The praise Dowell is constantly receiving on its development and application of *Inhibited* Acidizing is both appreciated and significant.

NOW AT STONEWALL, OKLAHOMA

Announcing the opening of a new station at Stonewall, Oklahoma, to serve the Fitts Pool, the Fitts Extension, and the Ada, Oklahoma Area. This station will be fully equipped for complete Dowell service and auxiliary chemicals. It is just one of the many advances by Dowell to speed up and extend its service.

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EUREKA, KANSAS — *PHONE, WRITE OR CALL AT ANY OF THE FOLLOWING OFFICES:* — SEGUIN, TEXAS

GREAT BEND, KANSAS · HOBBS, NEW MEXICO · LAWRENCEVILLE, ILLINOIS · LONG BEACH, CALIFORNIA · MIDLAND, TEXAS · MT. PLEASANT, MICHIGAN
NEWTON, KANSAS · SEMINOLE, OKLAHOMA · SHELBY, MONTANA · SHREVEPORT, LOUISIANA · TULSA, OKLAHOMA · WICHITA, KANSAS · WICHITA FALLS, TEXAS

OIL AND GAS WELL CHEMICAL SERVICE

The Month's Activities In Refining

Percent Refinery Capacity Operated

Western Division, 72.7 Percent **Central Division, 74.0 Percent** **Eastern Division, 80.0 Percent**

WORK began in March on the new refinery being constructed by the Nova A. G. at Schwechat, Austria. The total cost of the plant is estimated at 3,000,000 Austrian schillings. When the refinery is completed the old one at Drosing will be shut down.

●

The Northwest Refining Company has completed its refinery of 2500-bbl. capacity at Cut Bank, Montana. In addition to gasoline the plant is manufacturing tractor fuel and fuel oil.

Louis B. O'Neil is president of the company, G. N. McCabe and T. J. Landry vice-presidents, Virgil Nelles secretary-treasurer, Ralph W. Woods refining engineer, C. C. Peaker sales manager, and T. E. Bowen traffic manager.

●

The Bay Petroleum Corporation is constructing a refinery at Denver, Colorado. Ampco Engineering Company, Dallas, Texas, has been awarded the contract. A topping unit, with a charging capacity of 1650 bbl. daily, will be installed, as well as a Dubbs cracking unit of the multiple-coil, selective-cracking type, having a capacity of 900 bbl. daily. The latter will be the first Dubbs cracking unit ever built in Colorado.

A 68-70 octane gasoline, kerosene, tractor distillate, cracked fuel oil, and perhaps road oil will be manufactured. The plant will run on mixed Wyoming crudes from the production of the Ohio Oil Company.

M. H. Robineau is president of the Bay Petroleum Corporation.

●

Olney Oil and Refining Company have completed and put in operation a Gray clay treating plant at their refinery at Olney, Texas. The clay-treating plant is directly connected to their Donnelly-licensed cracking unit. Previously, the Olney refinery had been acid treating and rerunning its cracked gasoline.

The Godfrey L. Cabot interests of Boston, Massachusetts, will construct two natural gasoline plants in West Texas, one in Winkler County and one in Ward County. Each will have a capacity of 20,000,000 cu. ft. of gas daily. The company now is operating carbon black plants throughout the Texas Panhandle and West Texas areas.

●

The Continental Oil Company will erect a natural gasoline plant in the Gillis Field, Calcasieu Parish, Coastal Louisiana. A contract has been made with the Fohs Oil Company for 7,000,000 cu. ft. of gas daily. The site for the plant is on the west side of the field.

●

A new Ethyl fluid plant under construction at North Baton Rouge, Louisiana, is to be the first step in the decentralization of plants manufacturing ingredients for leaded gasoline, it is announced by the Ethyl Gasoline Corporation.

The plant, being constructed by E. I. du Pont de Nemours and Company, is expected to be ready for operation by July, employing an operating personnel of 150 men. The new facilities are planned for a production capacity equal to 20 percent of Ethyl's anticipated 1937 business.

Later a second unit will be constructed at North Baton Rouge, enabling the company to supply demands for antiknock gasoline in the Southwest and on the Pacific Coast from the Louisiana plant, and effecting a substantial saving on shipping costs under existing rates.

Crude Runs to Stills, Gasoline, and Gas and Fuel Oil Stocks
Week Ended April 3, 1937
A.P.I. Figures
(Figures in Barrels of 42 Gal. Each)

DISTRICT	Percent Potential Capacity Reporting	Daily Avg. Crude Runs to Stills	Percent Operated of Total Capacity Reporting	Total Motor Fuel Stocks Thousands of Bbl.	Gas and Fuel Oil Stocks Thousands of Bbl.
East Coast	100.0	541,000	80.9	18,548	6,462
Appalachian	88.4	94,000	72.9	2,920	541
Ind., Ill., Ky.	92.1	402,000	86.1	†14,177	4,403
Okla., Kans., Mo.	84.6	284,000	74.7	† 9,384	2,918
Inland Texas	54.3	119,000	65.0	2,236	1,280
Texas Gulf	95.5	657,000	86.8	10,626	6,546
La. Gulf	96.3	129,000	81.6	1,643	1,453
No. La.-Ark.	63.7	36,000	62.1	488	237
Rocky Mt.	69.7	51,000	82.3	1,994	731
California	90.9	471,000	63.1	14,974	68,106
Reported	88.8	2,784,000	77.1	76,990	92,677
Est'd Unreported	.....	221,000	.....	6,167	3,128
*EST'D TOTAL U. S. Apr. 3, '37	.....	3,005,000	.....	83,157	95,805
*EST'D TOTAL U. S. Mar. 27, '37	.....	3,060,000	.....	83,538	96,591
U. S. B. of M. *Apr. 3, '36	.....	**2,818,000	.....	74,387	96,730

*Estimated Bureau of Mines basis.
**April 1936 daily average.
†Revised for week ended March 27th as follows: Ind., Ill., Ky., 14,134,000 bbl.; Okla., Kans., Mo., 9,321,000 bbl.; Total U. S. remains unchanged. Revisions took place in stocks of "Finished Gasoline in Bulk Terminals, In Transit, and In Pipe Lines."

●

The Sinclair Prairie Oil Company plans to construct a natural gasoline plant in Moore County, Texas, with a capacity of from 40,000,000 to 70,000,000 cu. ft. of gas daily.

●

The Pure Oil Company has under construction at Heath, Ohio, a high-pressure combination topping and cracking unit. The unit, which is expected to be completed by October, will have a capacity of approximately 8000 bbl. of of crude daily.

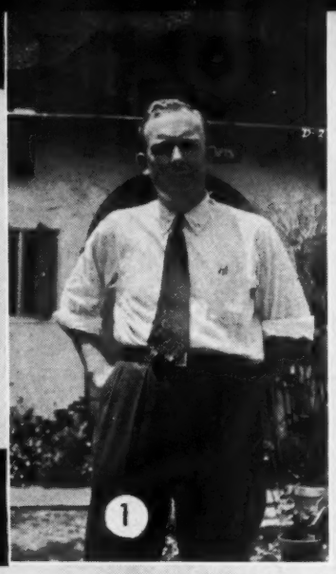
Pictorial
PETROLEUM

A REGULAR FEATURE OF THE PETROLEUM ENGINEER

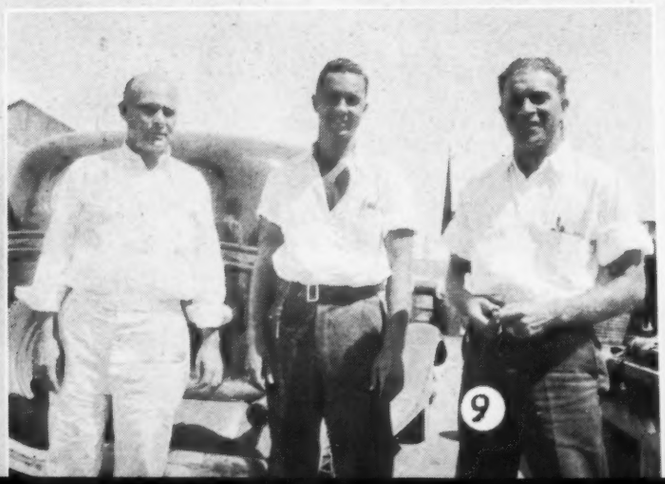
APRIL - 1937

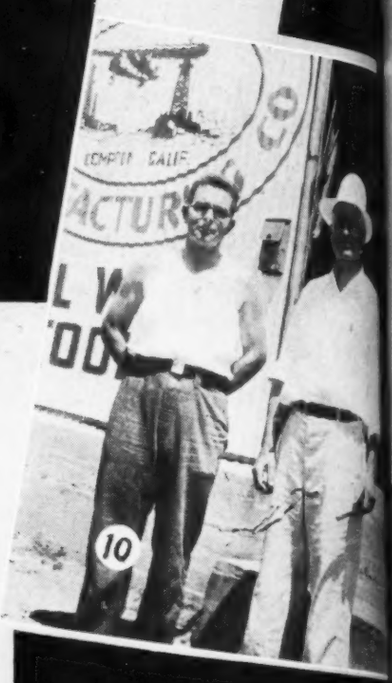
The now famous Texon Production Company's Sullivan No. 3 well in South Texas which has been burning since November 19 of last year. The ingenuity of the best fire fighters in the country has failed thus far to extinguish it. This very excellent photograph was taken by Paul R. Clegg, oil field photographer of Dallas, Texas.

Operating and Supply Men in California Fields

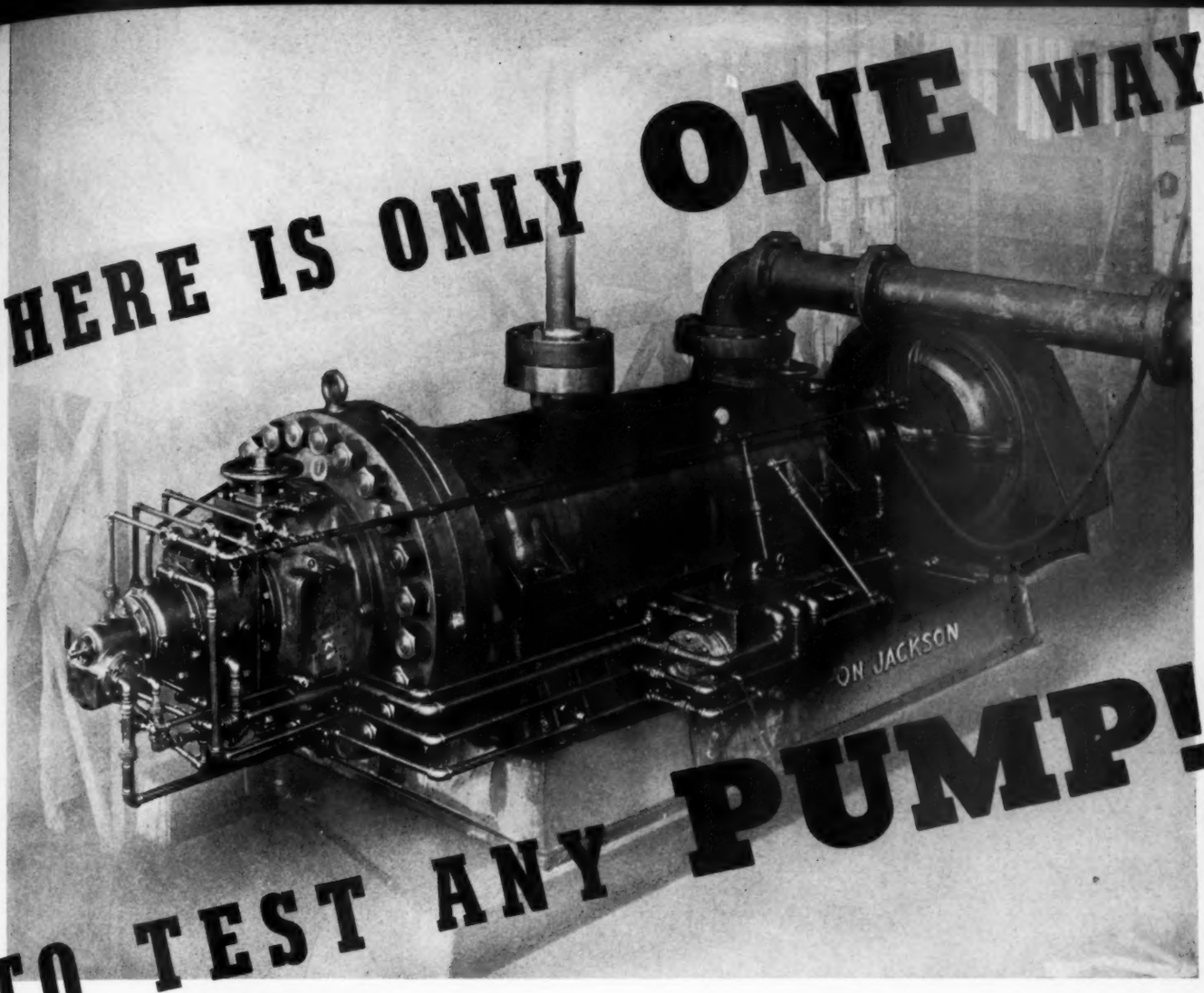


1. W. C. Fullilove, resident engineer, Sperry-Sun Well Surveying Co., Santa Barbara.
2. Paul Cavins, president (left), and G. C. Moore, sales manager, The Cavins Co., Long Beach.
3. F. L. Wadsworth, petroleum engineer, General Petroleum Co., Ventura.
4. Lester E. Peck, representative for Thornhill-Craver Co., Los Angeles.
5. Left to right—H. C. Wood, manager of Bakersfield district, Tunnell-Wood & Neilan; D. B. Church, Mason-Neilan Regulator Company, Boston, Mass.; and Ray Gard of Tunnell-Wood & Neilan.
6. Bill Robertson, drilling foreman, The Texas Company, Long Beach.
7. J. Preston Burroughs, chief clerk (left), and D. Fesler, drilling foreman, Barnsdall Oil Co., Rosecrans District.
8. R. C. Baker, Jr., and R. C. Baker, Sr., with Baker Oil Tools, Huntington Park.
9. Left to right—G. X. Michel, district manager for Byron Jackson Company; E. S. Brown, field representative for B-J; and Archie Gandy, production foreman, Geo. F. Getty, Bakersfield.
10. "Stump" Grafton, floor manager of Valley Warehouse, and Don Taylor, production foreman, General Petroleum Company, Bakersfield.





THERE IS ONLY ONE WAY TO TEST ANY PUMP!



ONLY by laboratory tests duplicating as closely as possible normal refinery operation can stresses be imposed to determine mechanical perfection.

This Byron Jackson Hot Oil Charging Pump — under test — is of double-case construction and may be direct connected to motor for constant speed, or steam turbine or dual drive for variable speed operation.

OTHER MODERN FEATURES

Low Pressure Stuffing Boxes . . . Minimum Number of Parts . . . Chrome Alloy Steels Provide Resistance to Coking, Corrosion and Erosion . . . No Diffusion Vanes . . . Available for Capacities of 2500 to 40,000 bbls. per day at Differential Pressures Required by Modern Refinery Practice.

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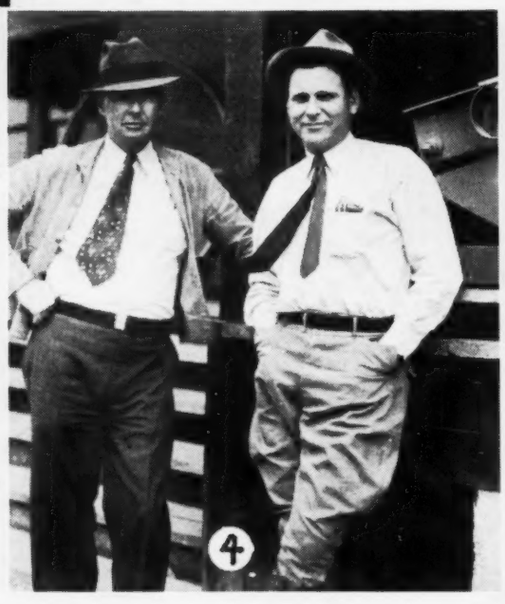
CENTRIFUGAL PUMPS FOR EVERY SERVICE

Established 1872

OPERATING and SUPPLY MEN in South Texas Fields



1. J. L. Davis (left), store manager, Republic Supply Co., Pettus, Texas, and B. H. Britt, tool pusher for Cosner & Cosner, Corpus Christi.
2. C. H. Wheeler (left), store manager for Houston Oil Field Materials Co., and Odie Bowen, drilling superintendent for Allied Drilling Co., Corpus Christi.
3. Arnold Teague, tool pusher, Merrick Drilling Co., Corpus Christi.
4. W. H. Dobbins (left), field representative for Texas Iron Works, Corpus Christi, and J. E. Webb, co-partner in the Baltic Drilling Co., Dallas.
5. "Smut" Rymal, superintendent for the Quintana Petroleum Co., Greta, Texas.
6. L. D. Webster (left), assistant division engineer, and A. B. Vanhouser, superintendent for Humble Oil & Refining Co., both at Taft, Texas.
7. Left to right—Bruce Seale, driller, J. A. Kimmey, chief clerk, and H. H. McFarland, superintendent, all with Tom Graham, independent operator, Corpus Christi.
8. "Buddy" Bridger (left), Halliburton Oil Well Cementing Co., and Roy Featherston, tool pusher for Geo. H. Echols, drilling contractor. Both make headquarters in Victoria, Texas.

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1. **COLD STARTING** — in any weather.
2. **FLEXIBILITY** — accelerates rapidly at touch of throttle.
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4. **DEPENDABILITY** — established by its records of performance in drilling, pumping and generating operations in the oil fields.
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The heart of the Cummins Diesel is its Fue. System. Only in the Cummins Diesel do you get the exclusive single-plunger, low-pressure pump which accurately meters the fuel charge delivered to each cylinder.

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PERATING and SUPPLY MEN in South Texas Fields

1

2

3

4

5

6

1. O. K. Smith, production foreman, Violet Oil Co., Corpus Christi.
2. Top row (left to right)—J. A. Kelley, drilling superintendent, Ben F. Carter, petroleum engineer, C. W. Dwigans, production clerk, all with United Production Co., Refugio, and R. W. Chapman, district representative for Mission Manufacturing Co. at Corpus Christi. Bottom row—Earl Edge, field superintendent, W. B. Hood, production superintendent, both with United Production Co., Refugio, and John Best, representative, Mission Manufacturing Co., Houston.
3. Matt Burford, purchasing agent, Richardson Petroleum Co., Corpus Christi.
4. J. M. Reynolds (left), field representative, Drane Tank Co., Shreveport, and J. D. Stanley, tool pusher, J & C Drilling Co., Aransas Pass.
5. Left to right—J. T. Hancock, field foreman, Texas Pipe Line Co., M. W. McGilvray, lease foreman, Southern Pipe Line Co., Joe Reed, assistant superintendent, and M. M. Roden, production superintendent, Southern Minerals Corp., all of Corpus Christi.
6. Left to right—T. P. Collins of Collins & Baker, Houston; W. M. Carter, superintendent Bishop Oil Co., Conroe; Roy A. Lomp, representative Merla Tool Co., Dallas; Vernon B. Gresham, Merla Tool Co., Houston; and R. B. Hickman, superintendent, Standard Oil Co. of Kansas, Conroe.
7. W. A. "Bill" Richardson, independent operator, Corpus Christi.
8. Back row (left to right)—W. T. Westergood, Edwards Wire Rope Co., Houston; W. M. Wallace, assistant superintendent, Taylor Production Co., Corpus Christi; E. L. Moon, chief clerk, Corpus Christi Refining Co. Front row—J. F. Whitehurst, refining superintendent for Corpus Christi Refining Co., J. H. Wells, superintendent, Taylor Production Co., Corpus Christi, and G. R. Whiteman, assistant refinery superintendent, Corpus Christi Refining Co.

7

8

9

LET'S GET THIS MUD BUSINESS STRAIGHT!

WEIGHT

What is the heaviest mud weight on the market?

VISCOSITY

What mud produces high weight with low viscosity?

FIELD EQUIPMENT

What Manufacturer of Weight Material first used laboratory equipped cars in the field?

WRITTEN FIELD REPORTS

What manufacturer first furnished operators with written field reports on drilling mud conditions?

ENGINEERING SERVICE

Who first gave the industry an engineering service as an aid to proper use of commercial mud?

COLOX EXCELS

WITHOUT EXCEPTION

COLOX

EXCELS IN ALL THESE IMPORTANT FEATURES

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SALES AND SERVICE

A division of the Geo. S. Mepham Corp.

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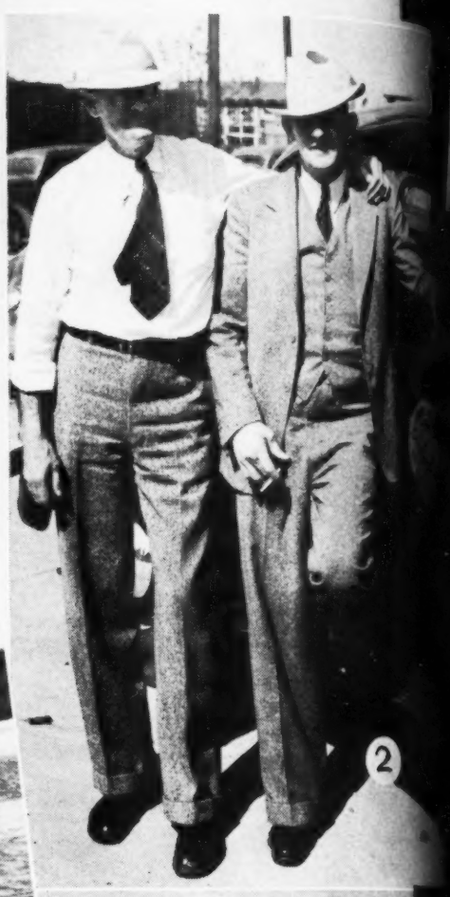
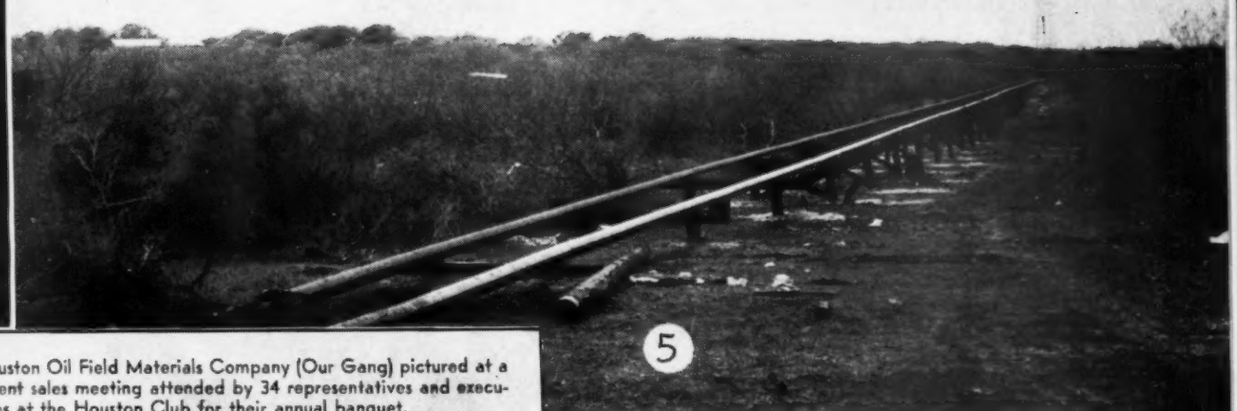
Scenes in the Corpus Christi Area



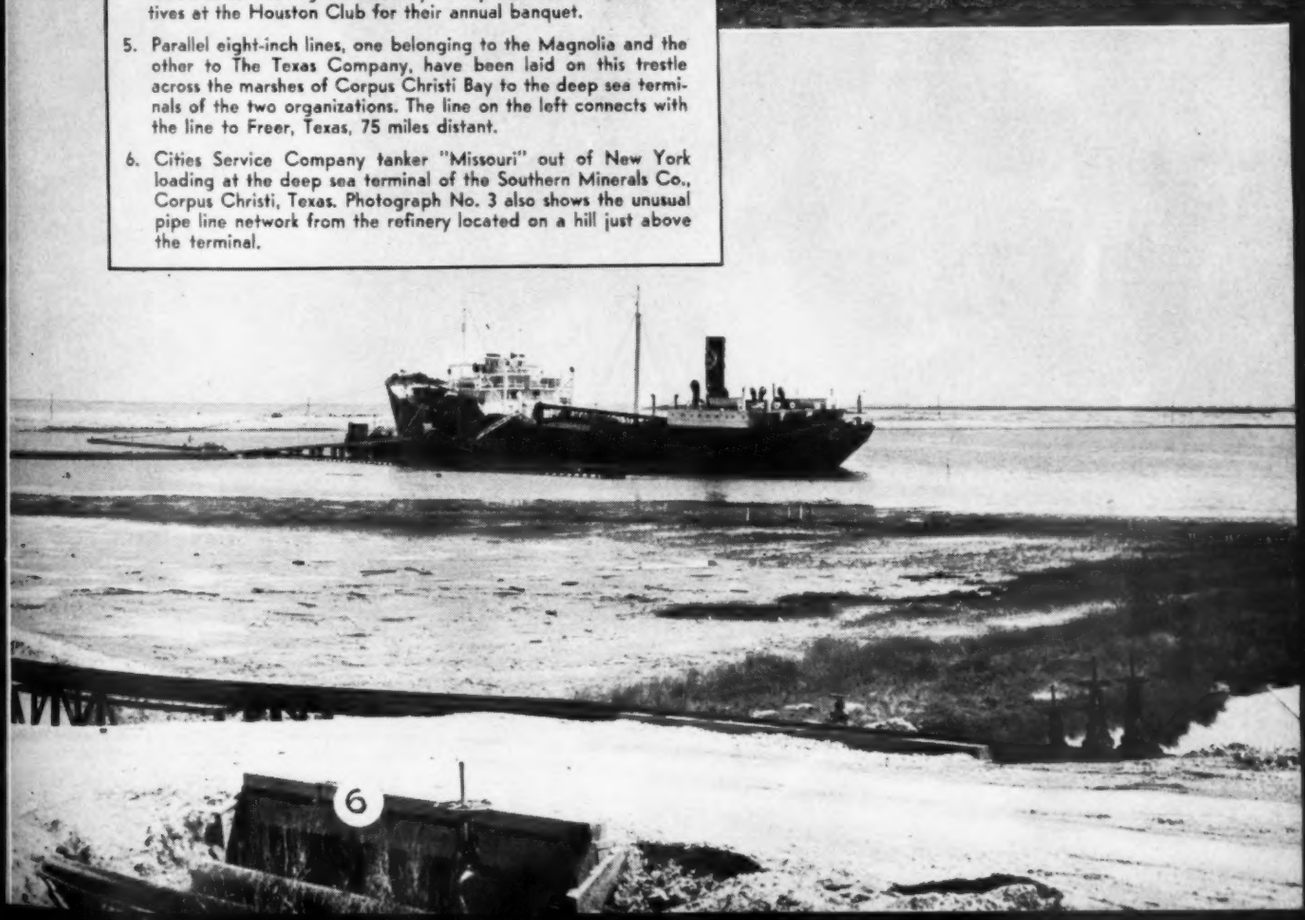
1. A day photograph of Texon Sullivan No. 3 well shown on the cover of this section in a night scene. This cratered well has been burning since November, 1936.
2. J. M. "Red" Teague (right), photgraphed with Paul T. Putnam, sales department, Cameron Iron Works, has been appointed district representative of Cameron Iron Works, Inc., in the Corpus Christi area.



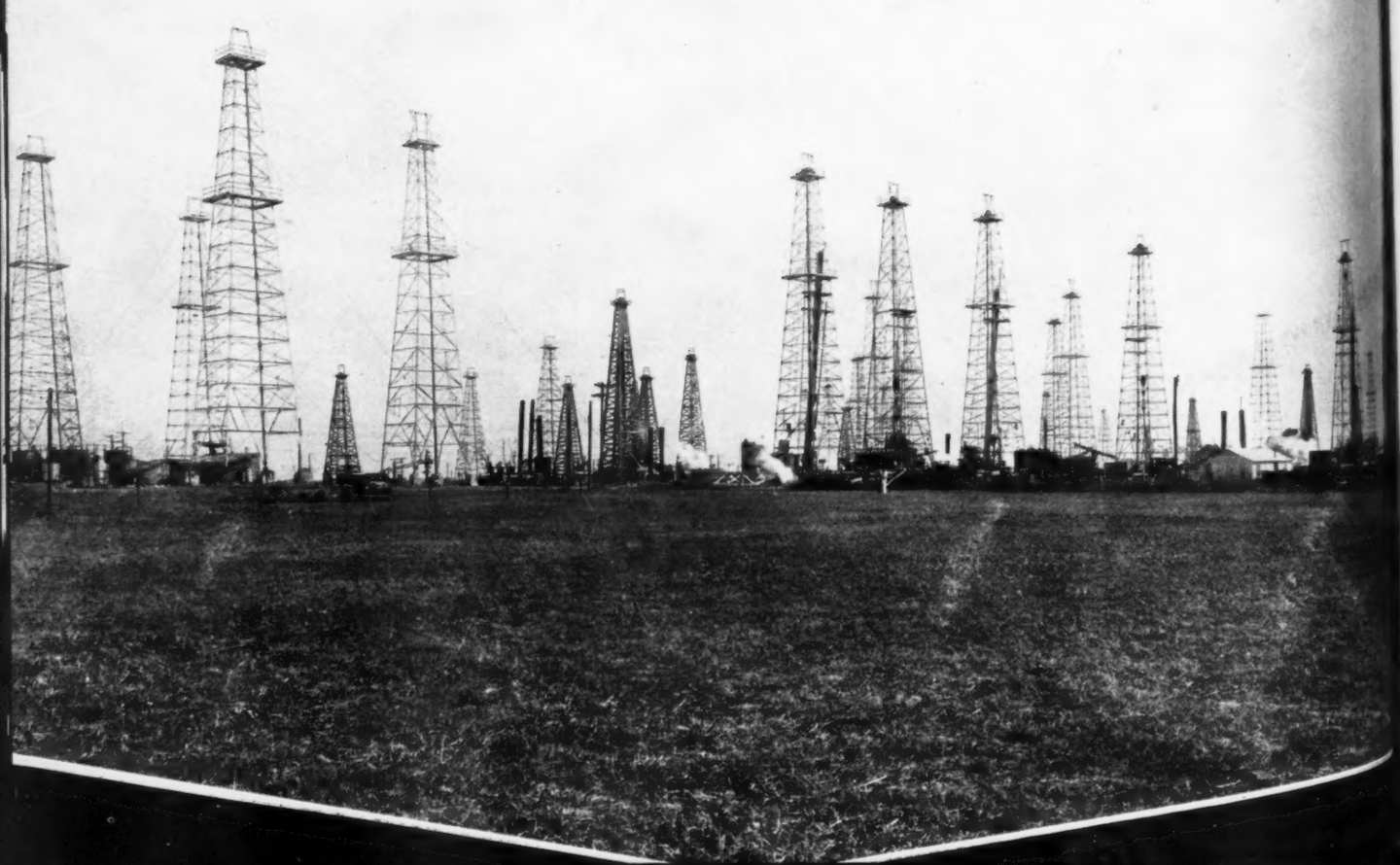
4. Houston Oil Field Materials Company (Our Gang) pictured at a recent sales meeting attended by 34 representatives and executives at the Houston Club for their annual banquet.

5. Parallel eight-inch lines, one belonging to the Magnolia and the other to The Texas Company, have been laid on this trestle across the marshes of Corpus Christi Bay to the deep sea terminals of the two organizations. The line on the left connects with the line to Freer, Texas, 75 miles distant.

6. Cities Service Company tanker "Missouri" out of New York loading at the deep sea terminal of the Southern Minerals Co., Corpus Christi, Texas. Photograph No. 3 also shows the unusual pipe line network from the refinery located on a hill just above the terminal.



Above—Caterpillar Diesel RD 8 tractor with LeTourneau Angledozer leveling base for erecting derrick and drilling. This is owned by Lang Transportation Co., Kettleman Hills, California. Below—A view of Barbers Hill, Texas, field.



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with complete stocks, sales
and service facilities for

KOBE
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SCREEN CASING

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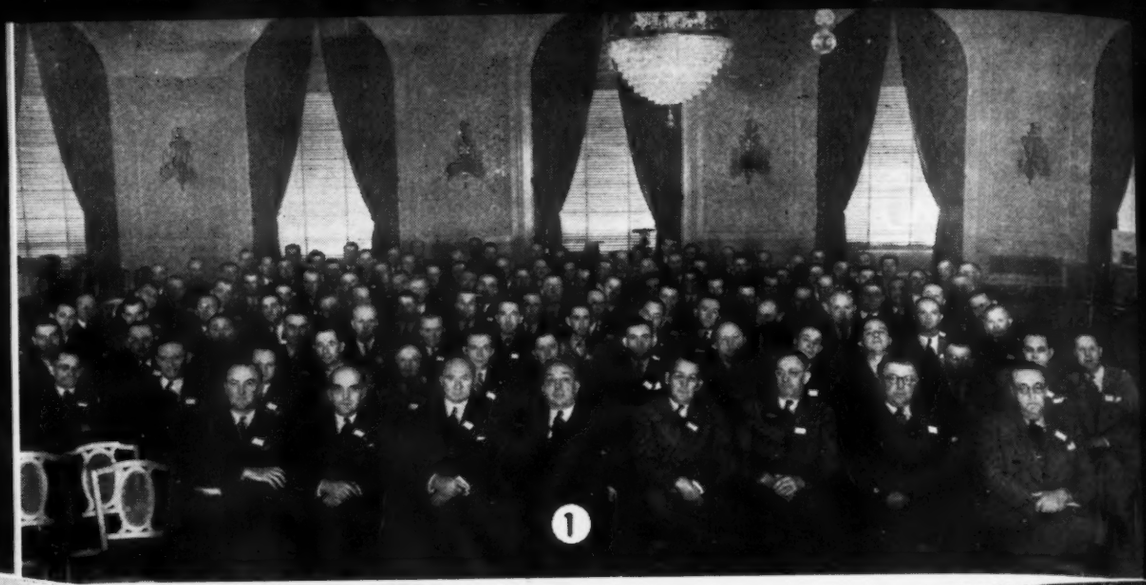
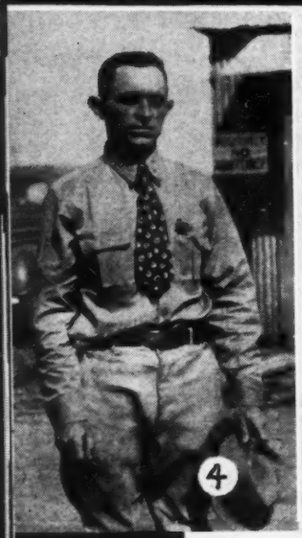




1. Continental Supply Company held its annual sales meeting in Dallas on March 22 and 23. This photograph shows officials and sales representatives of the Continental group who attended.

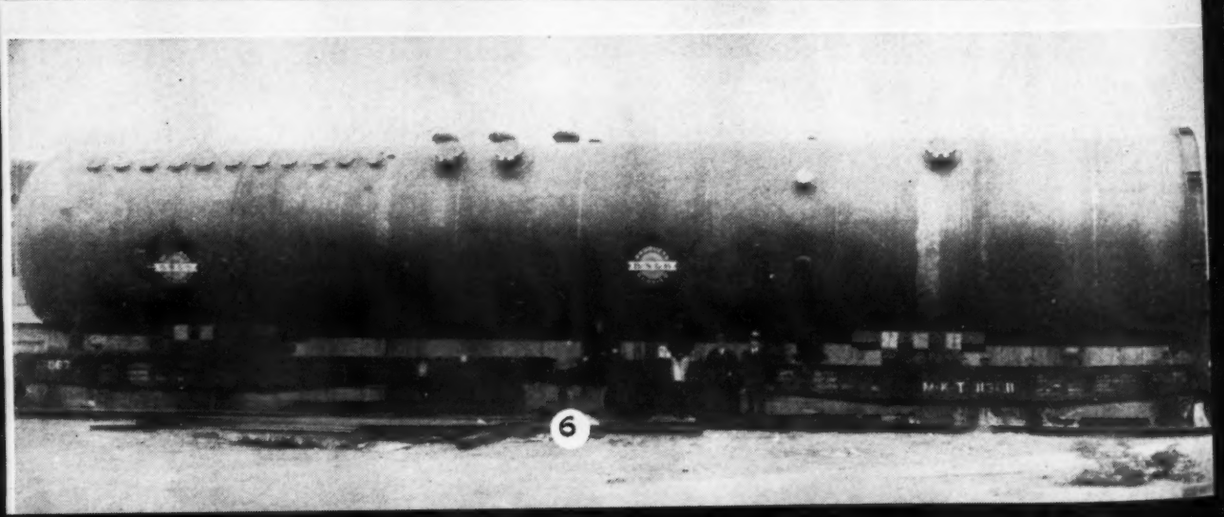
2. "Where there's a mule there's a way" might be the title of this photograph showing the resourcefulness of operating men in the Rodessa, La., field in maneuvering this Christmas tree into place. The tree was manufactured by Oil Center Tool Co. and the valves are W-K-M.

3. This photograph was sent to us by G. W. Moore of The Cavins Co., Long Beach, Calif., with the comment ."This is probably the first sit-down strike to take place in the oil fields. It occurred at Huntington Beach, Calif., and lasted only until five men climbed aboard the front end of the tank wagon and shoved it back on the street."

4. Hugh B. Ervin, superintendent of the Magnolia Petroleum Co.'s new absorption-type casinghead gasoline plant in the Fitts field, Okla.

5. Ray Bartels of the Continental Oil Co., Midwest, Wyo.

6. Black, Sivalls & Bryson, Inc., Oklahoma City, Okla., have called this tower "The biggest 'bubble' ever born in the Mid-Continent." It was so heavy that it overloaded the two 100,000-pound capacity flatcars and sagged them 2½ inches. The sag was increased to 5 inches when the tower reached Fort Worth, half way to its destination—Cosden Oil Corp.'s refinery at Big Spring, Texas.



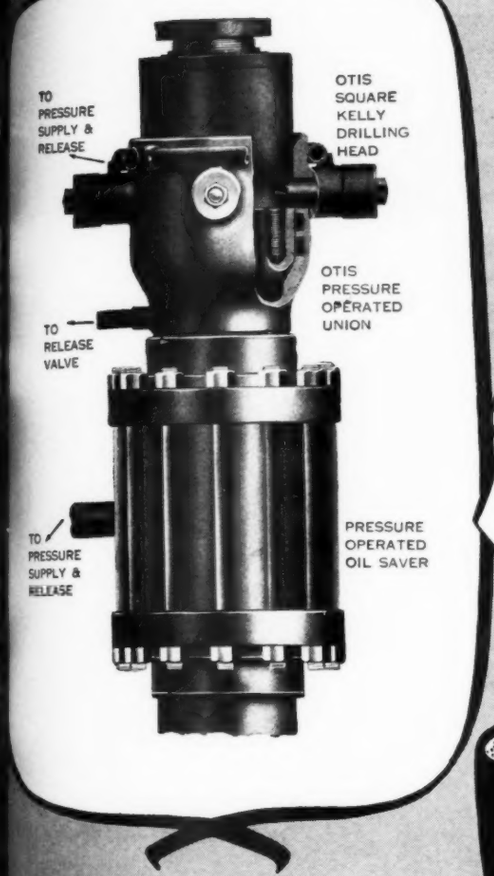
conventional rotary equipment was not the best method to use in completing these deep Wilcox sand producers the operators turned to the pressure control method of well completion and practically every well in this zone has been completed by this method since last summer

Capitol Building. This well was completed by the pressure control method of drilling-in because the bottom-hole pressure in the Wilcox sand is about 500 pounds and if mud laden fluid had been used while drilling into the pay formation it is probable the well would have been nonproductive. When the original wells were drilled in the Oklahoma City field the formation pressure was about 2,660 pounds.

While the cement was hardening the Otis square Kelly drilling head pressure control outfit was rigged up at the well. The regular drilling head was removed and in its place a 5,000-pound

...ed iron.
The next group of wells to be completed in this ...tension to the Wilcox zone will be handled with ...e Otis pressure control method and five of them ...re being drilled in this week and with their com... ...pletion much will be learned of this Wilcox sa...

a blowout preventer was placed. Then comes a short section of 9⅝-inch casing and a high pressure oil saver and immediately above the oil saver the Otis square Kelly packer is installed.


TO PRESSURE SUPPLY & RELEASE
OTIS SQUARE KELLY DRILLING HEAD
OTIS PRESSURE OPERATED UNION
TO RELEASE VALVE
TO PRESSURE SUPPLY & RELEASE
PRESSURE OPERATED OIL SAVER

With formation pressures in the Wilcox sand zone in Oklahoma City relatively low it has been found advantageous to complete new wells using the pressure control method of drilling. By this method relatively little pressure is placed upon the producing formation by the drilling fluid and better wells are secured.

So successful has been the Otis pressure control method of drilling that it has long since won the wide acclaim of the field. It's done more than that: It has received, without any mincing of words, the recognition of leading international oil industry magazines in their editorial columns. A few such comments, clipped at random, are reproduced here.

Making its first real strides in the Oklahoma City field, this method, embodying principally the Otis Square Kelly Drilling Head and Otis Pressure Operated Union, has definitely proven of revolutionary value wherever bottom hole pressure has declined below the hydrostatic pressure exerted by the weight of a heavy mud laden fluid column.

GIVING CREDIT WHERE CREDIT IS DUE

...t as the industry is turning to the Otis ...ssure control method of drilling where ...ditions make it necessary, the industry is ...ing for Otis Snubbing Service where the ...ning and pulling of tubing or drill pipe ...der pressure is necessary.

PRESSURE CONTROL - OTIS - SERVICE - EQUIPMENT TRADE-MARK

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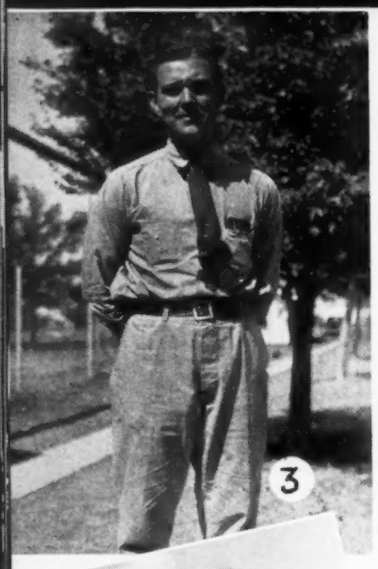
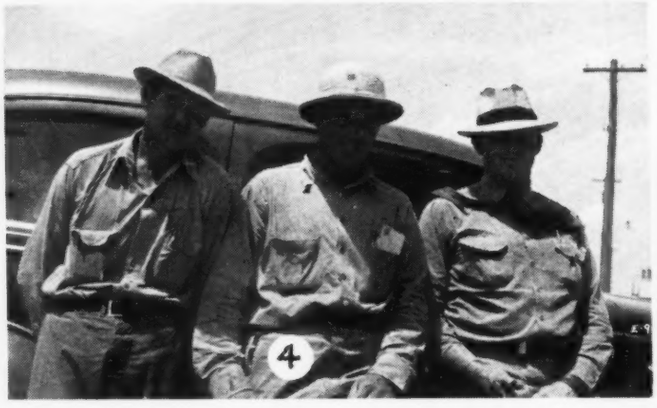
Headquarters: Tower Petroleum Bldg., Dallas, Texas

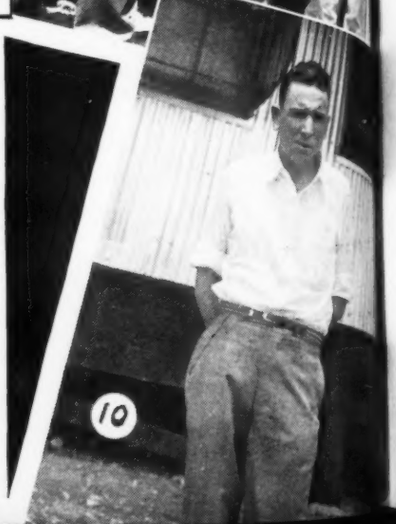
Branches: Houston, Shreveport, Oklahoma City, Ada, Hobbs.

Operating and Supply Men in West Texas





1. Left to right—J. Storrie, warehouseman, Atlantic Production Co.; J. W. Watson; Jack Phillips, tool pusher for E. B. Gooden, drilling contractor; (bottom row) Fred Turner, material man for the Atlantic Production Co.; and E. B. Gooden, drilling contractor, all of Wink, Texas.
2. W. W. Woods, superintendent of drilling and production for the Turman Oil Co. at Royalty, Texas.
3. R. D. May, chief operator of the Phillips gasoline plant, Crane, Texas.
4. Left to right—J. R. Beacon, boiler maker, Kermit, Texas; Lee Moore, drilling superintendent, Magnolia Petroleum Co., Wink, Texas; and Lonnie Jones, drilling and production superintendent, Navarro Oil Co., Kermit, Texas.
5. J. M. Miller, production foreman, Phillips Petroleum Co., Ibex, Texas.
6. Z. B. Morgan (left) and E. F. Hamor, pipe line engineers with the Humble Pipe Line Co. at Ranger, Texas.
7. Three Gulf Production Co. men. Left to right—M. S. Kenderdine, petroleum engineer, Crane, Texas; M. E. Norman, petroleum engineer, Crane, Texas; and E. D. Brockett, proration engineer, Odessa, Texas.
8. Charles Brady, chief engineer, Humble Pipe Line Co., Wink, Texas.
9. R. C. Tucker, district manager, Mid-Continent Supply Co., Midland, Texas.
10. L. E. Shiplet, district superintendent, The Texas Company, Wink, Texas.



THE Petroleum Engineer

APRIL, 1937

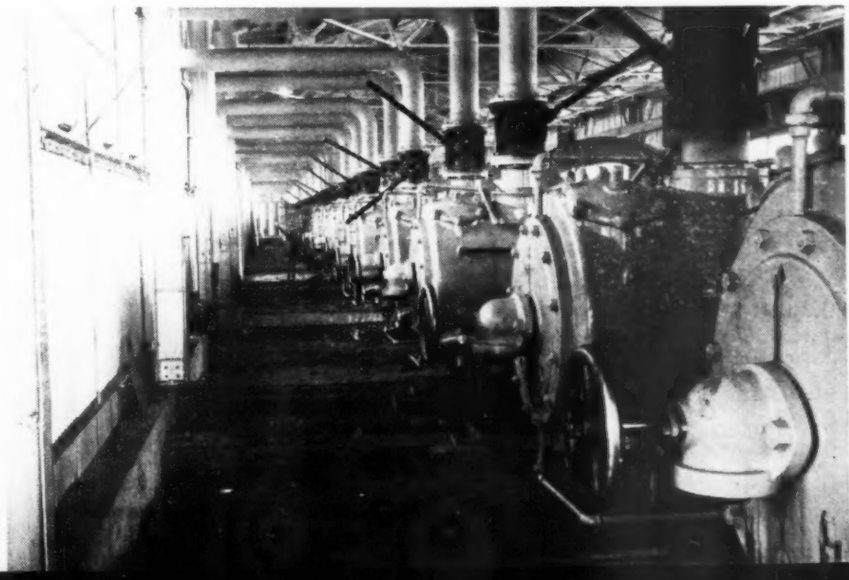
Absorption-Type Gasoline Plant in Fitts Field Embodies Interesting Features

By
FRANK H. LOVE

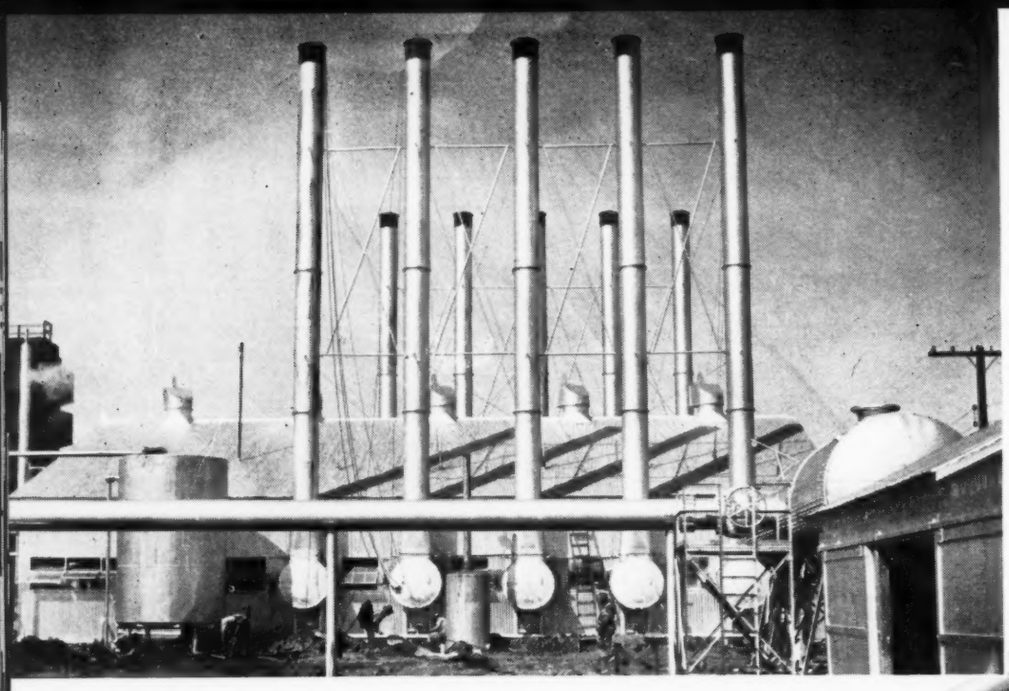
New plant contains two complete processing units that can be operated together or individually—automatic control devices an important part of the equipment

EMBODYING numerous outstanding features, the Magnolia Petroleum Company has completed a casinghead gasoline plant in the Fitts field of Pontotoc County, Oklahoma, of the absorption type and with a rated capacity of 30,000,000 cu. ft. of gas daily, manufacturing 60,000 gal. of gasoline.

In design the plant is two separate and complete units that can be operated together or individually. The distillation systems are tied together at the point where the gasoline is discharged from the stills; the oil circuits where the cooling coils leave the cooling tower; gas lines where the gas leaves the cooling coils; vapors from the stills at the stills, and the boilers at the boiler house. Each of the units will manufacture 30,000 gal. of gasoline

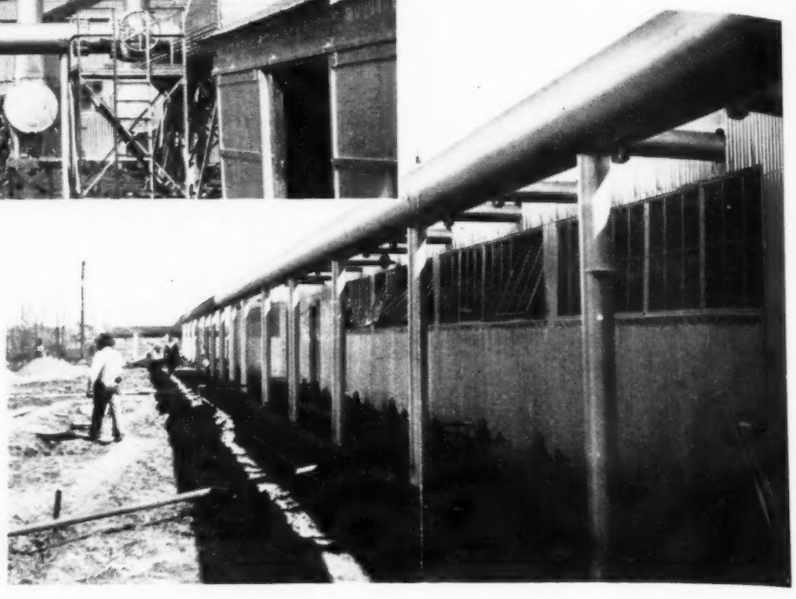


Fifteen 170-hp. units compress the intake gas to 35 lb. pressure. This photograph shows the compressor end of the units



Left—The steam plant, which has ten 100-hp. boilers, is operated at 175-lb. pressure

Below—The 24-in. suction header is carried overhead in the manner shown here



daily, and should requirements be limited in volume to the capacity of one the other can be shut down, effecting a considerable saving in operating expense.

In addition to this feature, the plant is under complete automatic control. Boilers, stabilizer, gasoline feed, reflux, top temperature of stills, and mineral seal oil flow all are controlled in this manner.

An attempt is made to maintain no more than eight inches of vacuum on the suction lines, and should it drop below that level an automatic control regulator releases the discharge pressure and places it back in the suction. Also, when this regulator starts operating it notifies the operators on duty by flashing red lights throughout the plant.

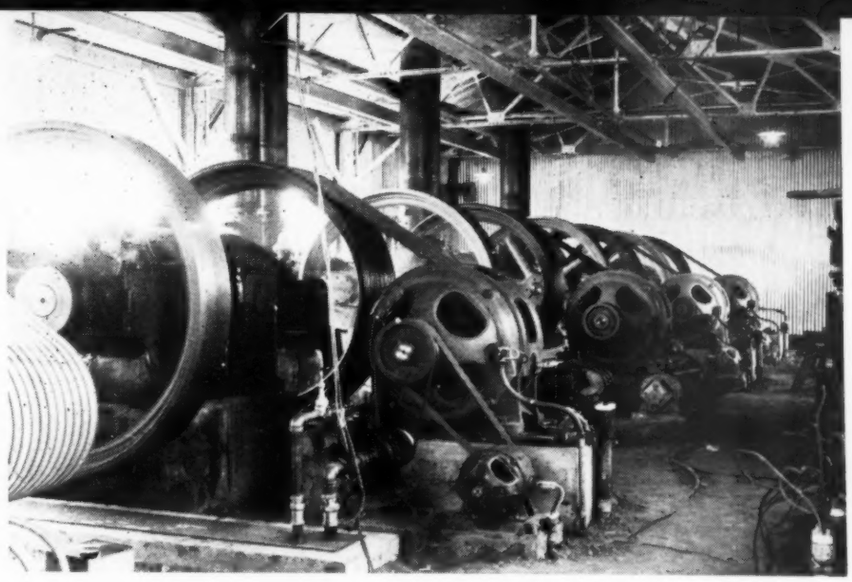
Another automatic control extremely important to the safety of the operating personnel, as well as the plant, is that regulating the boiler fuel feed and boiler dampers. From this instrument lines lead to various points throughout the plant yard where they are connected to stop valves. In all there are perhaps 20 of these valves. When closed they shut off the fuel to the boilers, close the dampers, and turn live steam into the fireboxes of the boilers. Should anything go wrong in the plant, a gasoline line break for instance, a stop valve can be closed in any part of the plant grounds that immediately extinguishes the boiler fires, and as this is the only fire in the plant, a possible serious conflagration readily can be avoided.

Connected to approximately 105 wells in the field, the plant is manufacturing a 22-lb. gasoline for blending purposes. Only wells owned by the Magnolia Petroleum Company are connected. The gathering system is composed of pipe varying in size from 8-in. to 24-in., bringing the gas to the plant at eight inches of vacuum to atmospheric pressure. Prior to being compressed to 35 lb. pressure by fifteen 170-hp. units with 18-in. compression cylinders, the gas is cleaned by two 8-in. by 20-in. horizontal scrubbers. Cooling water for the compressor engines is provided by 5-in. by 6-in. centrifugal pumps, driven by 15-hp. motors. After leaving the compressors the gas goes to the two 22-tray, 84-in. I.D. absorbers, and thence to residue. The fat oil passes through three heat exchangers and two preheaters to the two stills, the latter being 18-tray, 66-in. I.D. units operated at 40-lb. pressure and upon which are maintained a bottom temperature of 350-deg. fahr. and a top temperature of 190 deg. fahrenheit. From this point the lean oil is boosted through heat exchangers to the cooling coils in the cooling tower, thence back to the absorbers for the start of another cycle. Oil pumps consist of two centrifugal units for rich oil, two for lean oil, and one standby. The rich oil pumps are driven by 20-hp. motors and the lean oil pumps by 25-hp. motors. Each has a capacity of 500 gal. per minute.

After leaving the stills the gasoline vapors pass to the condensers, the gasoline then going to the surge tanks, one a 9-ft. by 20-ft. horizontal vessel, the other a 7-ft. by 10-ft. vertical unit. From the surge tanks it is picked up by feed pumps and sent to the stabilizer, a 30-tray 42-in. I.D. unit that is operated at a 200-lb. pressure, 204-deg. fahr. bottom temperature, and 150-deg. fahr. top temperature.

As the gas contains considerable sulphur it is necessary to treat the gasoline before it is ready for commercial use. Treating is with hydrochloride lime and the plant for this purpose consists of a surge tank, a mixer for the hydrochloride lime, and two vertical tanks. The gasoline is pumped directly from the stabilizer to the surge tank. The hydrochloride lime is blown under high pressure into the vertical tanks and through this is jetted the gasoline. The gasoline thus sweetened is sent to the horizontal stock tanks, of which there are 30, each having a capacity of 8000 gallons. A 12-car loading rack has been provided at Stonewall, a short distance from the plant, where it is loaded in tank cars for transportation to the refineries utilizing it for blending purposes.

Power for operation of electrical equipment is generated within the



Electrical-generating equipment consists of five 165-hp. gas engines driving generators through V-belts

plant. Electrical-generating equipment consists of five 165-hp. gas engines driving generators through V-belts. These units are in the building that also houses the fifteen 170-hp. compressors, a steel framework structure covered with corrugated sheet iron and measuring 332 ft. in length by 32 ft. in width, the electrical-generating plant and the engine room being separated, however, by a fire-wall. Five centrifugal pumps, driven by 15-hp. motors, supply cooling water to the 165-hp. engines. The pumps have a 2-in. suction and a 1½-in. discharge.

Water for the various operating purposes is obtained from a creek that runs through the field, being pumped to an overhead supply tank of 1600-bbl. capacity. Water is circulated over the cooling tower by four 8-in. by 10-in. centrifugal pumps driven by 40-hp. motors. Each unit is capable of pumping 1700 gal. of water a minute. The tower measures 247 ft. 6 in. in length, 25 ft. in width, and is 60 ft. in height, having a capacity of 6800 gal. per minute.

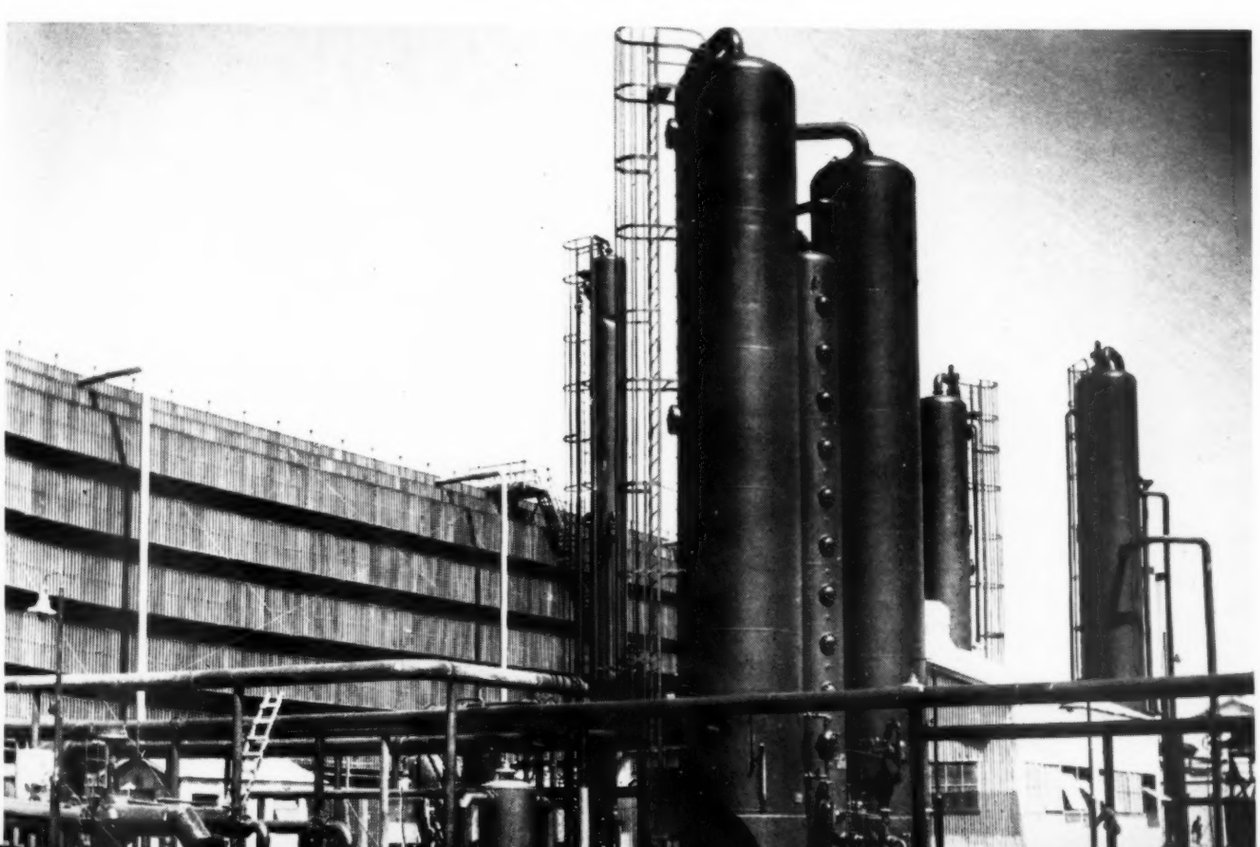
The steam plant is operated at a pressure of 175 lb. and has a working pressure of 300 pounds. Principal equipment consists of ten 100-hp. boilers. Two 10 by 7 by 13 boiler-feed pumps boost water to the boilers from two 217-bbl. supply tanks situated immediately outside the boilerhouse. Two additional centrifugal pumps are utilized to pick up condensate from the preheaters and return it to the boilers. The boilerhouse is constructed of a steel framework covered with corrugated sheet iron.

As much of the piping as possible is above ground where it will be easily accessible for repair or adjustment. The 14-in. discharge header from the compressors is two inches above ground level, and the 24-in. suction header is carried overhead in the manner shown in one of the accompanying illustrations. All heavy units are set in concrete foundations; light fixtures are of vapor-proof construction; and in addition to the inlet scrubbers mentioned there are two smaller intermediate scrubbers situated between the cooling tower and the absorbers.

The office and laboratory buildings are separate structures, both being of wood construction. Convenient housing facilities are provided for the operating personnel. Near the plant are five company cottages, modern in every respect.

Hugh B. Ervin is in immediate charge of the plant's operation as superintendent.

The reasborber and two absorbers are seen in the foreground; in the background to the right are the two stills; the stabilizer is in the left background



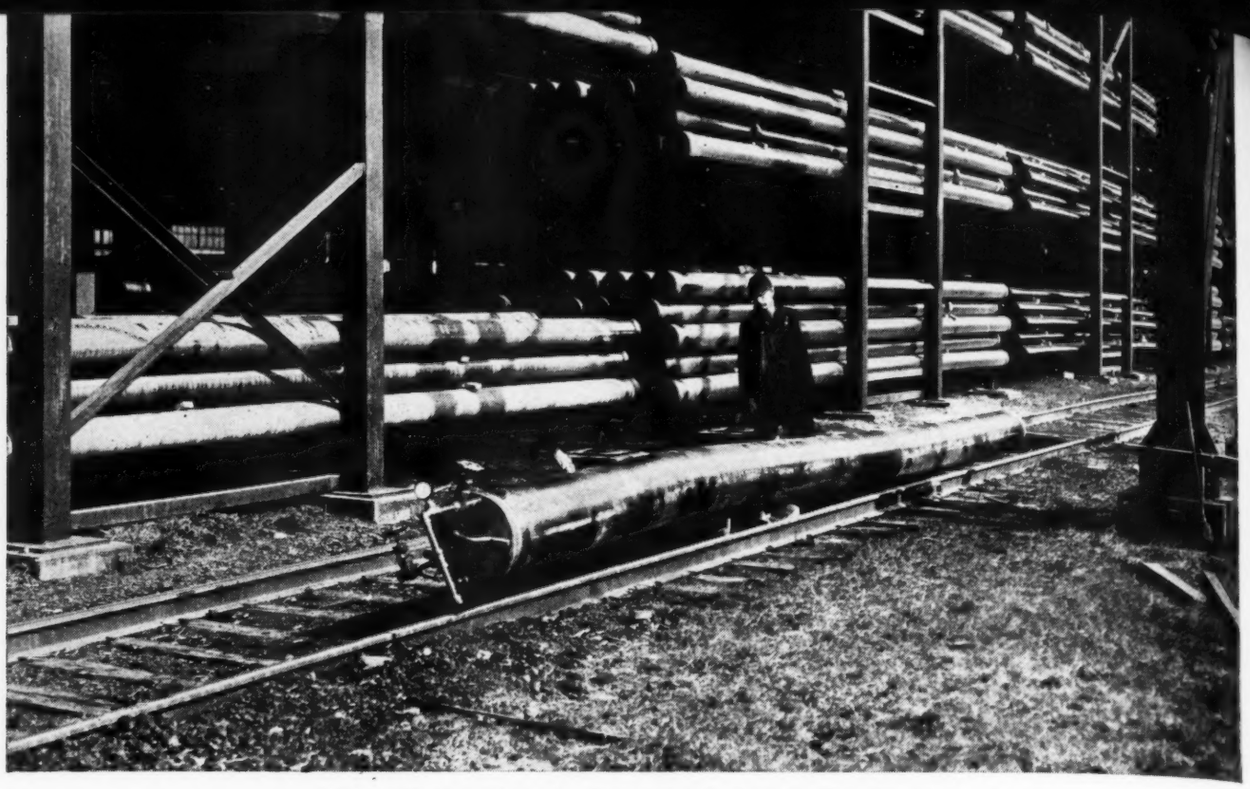


Fig. 1. Determining the Strength of pipe by the drop test

Basic Factors Affecting the Design of a Natural Gas Transmission System

By J. STANLEY STEVENSON, Chief Engineer
Panhandle Eastern Pipe Line Company

Maximum permissible operating gas pressure, diameter and wall thickness of pipe, and spacing of compressor stations are a few of the considerations involved

A MODERN natural gas transmission line is proposed; producing acreage has been leased; a market has been assured by the signing of contracts; the approximate length of the proposed line is thus fixed; peak day deliveries have been estimated, based upon an analysis of the potential gas consumption of the new sales territory; a probable load factor has been developed. These elementary facts and figures must be known before even a beginning can be made on the economic design of the proposed transmission system. There are many other factors entering into and affecting the final design, the principal elements of which are the maximum permissible operating gas pressure, the diameter and wall thickness of the pipe, and the spacing of the compressor stations along the line.

Maximum Gas Pressure

Remarkable improvement in the composition of steel and in methods of pipe manufacture in recent years have provided the industry with pipe having a yield point of 45,000 lb. per sq. in. or higher and an average ultimate tensile strength of more than 70,000 lb. per sq. inch. The maximum permissible fiber stress in the pipe walls (hoop stress) determines the maximum operating gas pressure of the proposed line, which in turn determines the diameter of the pipe line under design.

Hoop stress in the pipe may be determined by Barlow's formula:

$$S = \frac{PD}{2t}$$, in which

S = permissible fiber stress in lb. per sq. in. in pipe walls.

t = thickness of wall of pipe in inches.

D = outside diameter of pipe in inches.

P = gauge pressure in lb. per sq. inch.

The maximum permissible gas pressure, the diameter of the gas line, and its wall thickness may be determined from this formula, using a factor of safety (preferably not less than two, based upon yield point) for the hoop stress. A minimum wall thickness that will permit shipping, rough handling, welding, and bending the pipe without causing it to become "out of round," or otherwise damaged, and that will provide a certain amount of protection against the loss of metal due to corrosion, is selected. There is no formula for fixing the minimum wall thickness of pipe. Experience alone determines this important economic factor.

Many different formulas have been developed and used in estimating the flow capacity of high-pressure gas pipe lines. Weymouth's formula is generally accepted, however, as expressing more closely than any other the actual flow of gas under a given set of conditions.

This formula is:

$$Q_s = 433.45 \frac{T_s}{P_s} d \frac{8}{3} \sqrt{\frac{P_1^2 - P_2^2}{L S T_1}},$$

where Q_s = flow, cu. ft. a day under standard conditions (P_s and T_s).

d = internal diameter, inches.

P_1 = initial pressure, lb. per sq. in. abs.

P_2 = terminal pressure, lb. per sq. in. abs.

P_s = standard pressure, lb. per sq. in. abs.

L = length of pipe line, miles.

S = specific gravity (air = unity).

T_1 = absolute temperature of flowing gas, deg. fahr. abs.

T_s = standard absolute temperature, deg. fahr. abs.

The formula may be simplified for a given set of conditions by reducing the factors of standard temperature, flowing temperature, standard pressure, and specific gravity of the gas to a constant. We then have:

$$Q_s = A\sqrt{\frac{P_1^2 - P_2^2}{L}},$$

where A = constant, known as "A" factor.

Diameter and Wall Thickness

The carrying capacity of a pipe line is directly proportional to the "A" factor, the length of line and pressures and temperatures remaining constant. As an example, for a given set of conditions the "A" factor for 12¾-in. O. D. pipe is 615,900, while that for 24-in. O. D. pipe is 3,645,000, which indicates a carrying capacity of nearly six times that of the smaller diameter pipe. The combined carrying capacity of the two sizes operating in parallel would be reflected by combining the "A" factors, and the carrying capacity of a pipe line looped with a line of different diameter may be estimated in this manner.

Having decided upon the minimum wall thickness, the selection of the diameter of the pipe line is then dependent upon several factors, the more important ones being the quantity of gas to transport on peak days and the maximum pressure drop between compressor stations. In a sense, gas is not directly forced through a pipe line, just as water is not forced downstream in the bed of the river. Gas flows in a pipe line because of a difference in pressure between the upstream, or discharge side of a compressor station, and the downstream, or intake side of a station, or between a gas well connection and any point of discharge; a river flows toward the sea because of a difference in pressure, or head.

Now, since the flow of gas, or carrying capacity of the pipe line, is directly proportional to the square root of the difference in squares of the absolute pressures, according to Weymouth's formula, the designer will strive to use the highest differential consistent with economic practice. The next important factor in the design, therefore, must be determined. This factor is the peak day ratio of the absolute pressure on the discharge side of the compressor to the absolute pressure on the intake side of the compressor, or P_1/P_2. This is known as the compression ratio, or "R."

The economic balance of horsepower and pipe investments of the completed transmission system depends in a large measure upon a wise selection of R. Several studies of estimated costs of the proposed transmission line, including operation and maintenance costs of the compressor stations and of the pipe line, based upon different compression ratios may be necessary in the determination of this factor. Upon its selection will depend the spacing and number of compressor stations, the necessary horsepower, the efficient operation of compressor units, and many other factors of lessor importance.

Increasing the Facilities

As the ultimate load of a pipe line laid to a new market for natural gas is not known at the time the line is designed, the capacity of the line may be insufficient to handle deliveries as markets are developed. On the other hand, all compressor stations required for ultimate conditions are not constructed at the time the line is built. As sales increase and deliveries grow from year to year, stations originally omitted are constructed and units added to existing stations, until the full carrying capacity of the system is reached. From this point on, if additional capacity is again required, the adding of horsepower alone is un-economic due to the resultant increase of the compression ratio beyond the ratio established by the designer as the most efficient from standpoint of original investment and operating efficiency and costs.

It now becomes advisable to consider the construction of loops, or parallel pipe lines, extending a part or all of the way between stations. A preliminary capacity study of the existing pipe line system, using a revised estimation of peak day ultimate demand, will guide the designer in his selection of pipe diameters of loops. Based upon pipe sizes thus determined, and again using an economic compression ratio, the carrying capacity of each section of the line between stations is carefully balanced between horsepower and line pipe by the addition of loops of the required lengths.

Construction Methods

The common practice of natural gas pipe line companies is to use reciprocating-type, horizontal twin-tandem, double-acting natural-gas-powered engines, direct connected to compressor cylinders. On large capacity lines twin engines developing 1000 b.hp. or 1300 b.hp. are being used. Compressor stations are spaced, generally, 70 to 90 miles apart and the units generally operate on a gas compression ratio of 1.7 to 1.9 during peak periods.

Fig. 2. Condition of pipe following a burst test to determine its strength

The pipe line itself is constructed of steel pipe in random lengths of 20 or 40 feet. On 18-in. pipe and smaller, welding generally is used to join the lengths. Pipe lines larger than 18-in. are constructed with mechanical couplings of the ring and follower type that provide joints of permanent tightness with flexibility to absorb pipe movements during and after installation. This practice may be varied by constructing a composite welded and coupled line, two 40-ft. lengths being joined by welding and the 80-ft. lengths then connected with couplings. Pipe is laid in a trench excavated to a width not less than 6 in. greater than the outside diameter of the pipe and is provided with at least 30 in. of cover.

Drips are installed at suitable points along the line to provide a means of collecting and blowing the condensate. The present trend toward the construction of gas dehydrating plants on long transmission lines is greatly reducing operating troubles caused by water and other liquids in the line.

Where pipe lines are laid under water, across river bottoms or bays, the buoyancy of the lines is overcome by the use of heavy cast-iron river clamps installed over the joints. Multiple lines generally are provided at such points, these lines being arched upstream where submerged in a river channel, and as a further protection the lines are trenched below the bed of the stream.

Pipe Tests

The necessity of having pipe of uniform strength throughout the entire length of the pipe line is apparent where a relatively low factor of safety has been used in the design of the line. Striving to produce such uniformity, the manufacturer tests each joint at the factory under hydraulic pressure in excess of the proposed maximum operating pressure of the line, in addition to routine laboratory tests. While under test pressure the pipe is subjected to blows from a series of mechanically-operated hammers.

The physical properties of the steel and the ultimate strength of the pipe are thoroughly tested from time to time. Fig. 1 illustrates a drop test conducted on a 38-ft. length of 16-in. pipe with a wall thickness of ¼-inch. This pipe, filled 85 percent with water and 15 percent with air at 600-lb. pressure, was dropped from a vertical position, landing on wooden blocks. The resulting dent was across the longitudinal weld. Tests were continued on this length, while still under 600-lb. pressure (air and water), by subjecting the pipe to a series of blows from a 625-lb. weight dropped a distance of 16 feet. The pipe was then tested to failure, as illustrated in Fig. 2. The pressure at burst was 2215 lb. per sq. inch.

To Invite World Congress to Meet With Tulsa Exposition in 1938

PLANS are being completed for the 1938 International Petroleum Exposition in Tulsa, Oklahoma, with the appointment of D. E. Buchanan, chairman of the board of Hanlon-Buchanan, Inc., to head the Tulsa oil show civic committee.

J. Garfield Buell, chairman of the Exposition's committee to arrange for a delegation to attend the World Petroleum Congress in Paris this June, says that approximately 20 leading oil men are planning to go and will present an invitation to the congress to hold its 1940 meeting in Tulsa in conjunction with the 12th International Petroleum Exposition.

The invitation will be on a 6-ft. parchment scroll, says General Manager Wm. B. Way. A film of exhibits and events at the last International Petroleum Exposition will be shown at the Paris Congress.

Anyone interested in information about the tour should write Buell, Mayo Building, Tulsa.

The committee appointed to serve with Buchanan in arranging for housing facilities, helping to arrange meeting places, provide for the entertainment of visiting oil men, and making other local arrangements for the 1938 Exposition includes: R. O. Dietler, Stanolind Oil and Gas Company, vice-chairman; W. R. Francisco, Deep Rock Oil Company; A. O. Olson, Olson Drilling Company; C. F. Camp, Arrow Drilling Company; W. K. Warren, Warren Petroleum Corporation; George Manahan, Manahan Oil Company; R. B. Pringle, Tide Water Oil Company; Charles Klein, Mid-Continent Petroleum Corporation; N. K. Moody, Sinclair Prairie Oil Company; C. L. McMahon, independent operator; John Mabee, Mabee Consolidated Corporation; E. B. Reeser, Barnsdall Oil Company; Jay P. Walker, National Tank Company; L. D. Armstrong, Gaso Pump and Burner Manufacturing Company; C. D. Watson, Carter Oil Company; Frank Hugill, First National Bank; D. R. Trax, Gulf Oil Corporation; Henry Keplinger, Shell Petroleum Corporation; Van Bennett, British American Oil Corporation; E. Fred Johnson, Fourth National Bank; C. H. Wright, Sunray Oil Company; T. F. Birmingham, Margay Oil Company; E. R. Filley, The Texas Company; Ernest Klappenbach, Oil and Gas Journal; H. M. Cosgrove, Purchasing Agents Association; O. E. McClatchey, Barnsdall Oil Corporation; L. B. McCammon, Ohio Oil Company; Mark S. Patton, Hurley Gasoline Sales Company; H. W. Camp, Empire Refining Company; Glenn Ames, Phillips Petroleum Corporation; W. A. Brownlee, National Bank of Tulsa; and Dr. Sidney Born, University of Tulsa.

Diesel Fuel Injection Systems

By
ORVILLE ADAMS

Mechanically-operated constant-pressure injection nozzles of the common-rail system explained, together with a discussion of the single-plunger distributing system

THREE systems of fuel injection are employed in the Diesel engine that fulfill the requirements of quickly injecting into the combustion chamber small quantities of fuel at high pressure. They are the individual cam-driven fuel pump for each cylinder, known as the "jerk-pump" system, discussed in the January issue of *The Petroleum Engineer;* the "common-rail"

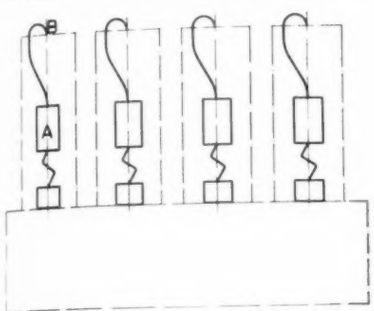


Fig. 1. Mechanical injection: individual pump arrangement

system, usually called the "constant-pressure" system, which may be more specifically described as a mechanically-operated injection nozzle; and the single-plunger distributing system. Several important modifications of the constant-pressure system exist. The principle of this method is to deliver the fuel from a pump to a common reservoir, or tank, sometimes called an accumulator, whence it is led to the different fuel valves or nozzles. In most designs the injection valve in the cylinder head is opened by a cam on the overhead cam shaft, the valve being operated by suitable mechanism. The construction of the valve as used on many slow-speed engines is similiar to the air valve used on air-injection Diesel engines. The actual nozzle used does not differ from the hydraulically-operated type employed with pump injection.

Equal distribution of the fuel to all cylinders in a Diesel engine at variable loads and speeds is difficult to maintain with most systems of fuel injection, on account of possible inaccuracies, uneven wear, deflection, and heat expansion of its many parts.

Earlier difficulties with high-pressure individual-pump injection systems are reflected in the bewildering variety and more or less complicated fuel pump and spray devices to be found in current practice and described in patent literature. This provided an impetus to the further development and perfection of the cam-operated system or common-rail methods. In view of the vital importance of these methods it may be well to discuss the newest developments in the common-rail method of fuel injection and its modifications as now employed on some of the more important and widely-used engines.

There are several engines that still use their own common-rail system of fuel injection. These systems are highly perfected, much progress having been made in overcoming the earlier objection to their use on moderate high-speed applications. A popular oil field application employs a modified common-rail or constant-pressure system of fuel injection. Though the system is called a constant-pressure system—that is, the pressure is constant for any given point or setting—the system actually is an adjustable pressure system in that the pressure may be varied over any desired range, either automatically or manually to suit conditions.

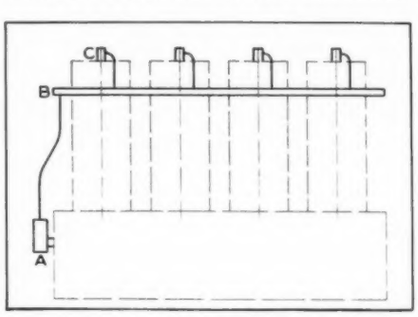
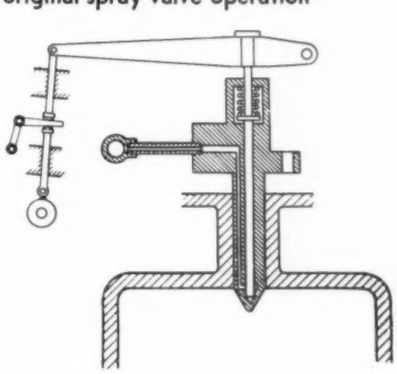


Fig. 2. Mechanical injection: constant-pressure system arrangement

In order first to understand and observe the distinctive features of the two systems, both are compared. Fig. 1 represents an intermittent injection, jerk pump or pump injection. A is a quick-acting pump and B the injection nozzle. There is one pump for each cylinder. High-injection pressure is necessary for atomization and this is attained by delivering a measured quantity of fuel through small orifices in the nozzle at high velocity. Fuel injection is governed by limiting the filling of the pump or by opening a by-pass valve at some point in the pump stroke, cutting off the fuel or pressure.

Fig. 2 shows the constant-pressure system or common-rail. In this diagram, A represents a fuel pump driven by the engine, and usually not timed; and B represents a high-pressure tube or "rail" or accumulator from which fuel goes to all cylinders, and C is the injection valve or spray nozzle. The timing of injection is accomplished by means of timing this spray valve. Such a valve once was commonly operated as shown in Fig. 3, which is the usual form of the original application of this system. The operating mechanism for the spray valve was situated on top of the head, as was the governor control that usually was in the form of a wedge, the latter being either directly at the top of the spray valve or in the push rod operating the cross lever. It was necessary to break all connections and disturb all adjustments whenever the fuel valve itself was removed. Whenever the inlet or exhaust valves were serviced and the cylinder head or piston

Fig. 3. Diagrammatic arrangement of original spray valve operation



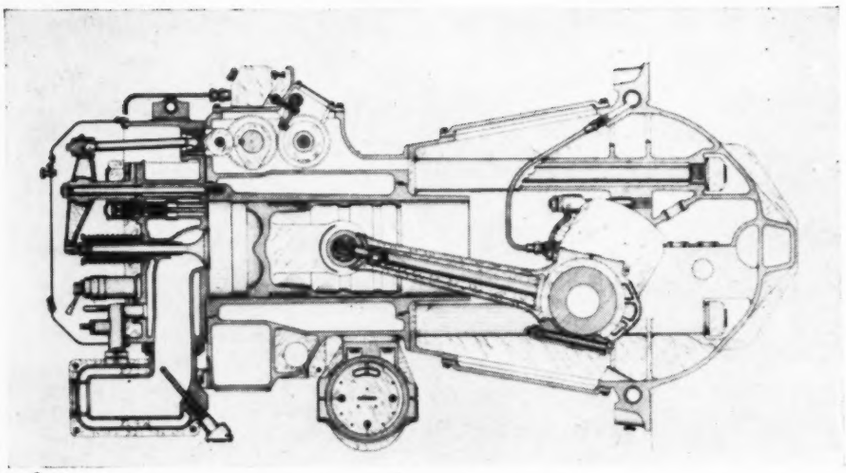


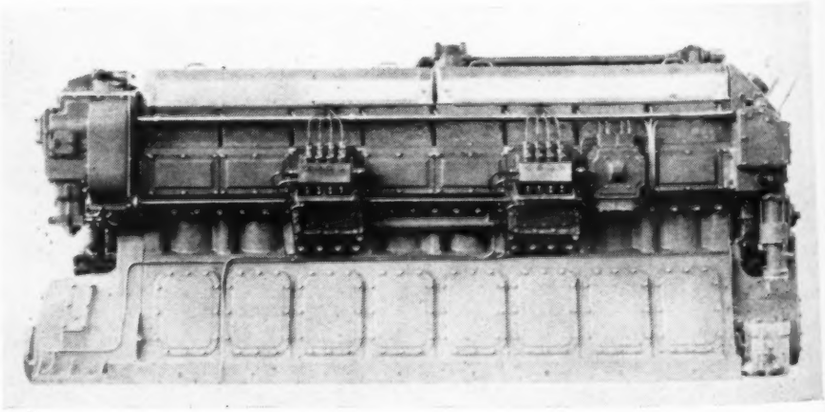
Fig. 4. Old type Cooper Bessemer Diesel now obsolete

removed, the entire system for that cylinder was disturbed. This was a serious disadvantage to the operator who had to learn how to reset the entire system, and he did not always find this easy to learn. This complication is shown further in Fig. 4, which is a cross-section of the system long since abandoned as obsolete by Cooper-Bessemer designers on account of these difficulties. On this engine the spray valve was placed at the usual point in the center of the cylinder head, while a rocker arm of heavy cross-section extended to a point where it could be operated directly from the camshaft by means of a push rod. Governing the spray valve was a shaft that ran longitudinally across the tops of the cylinder heads and operated a wedge at the top of each spray valve stem. This rocker arm and all its operating mechanism of necessity were constructed of heavy cross-section in order to get the desired stiffness, as a very small deflection in any of these parts would result in considerable variation in the cylinder loadings, or uneven injection of the fuel. The engine would not fire evenly at lighter loads and it was common for half of all the engine cylinders to "miss" when idling. It was desirable therefore to eliminate the necessity for disturbing the fuel settings when doing overhaul work, and reduce the difficulties of maintaining balanced loads on the cylinders at all speeds and loads. This has been accomplished by transferring all injection mechanism to a centralized location, compact like the fuel pump injection, to the side of the engine, as shown in Fig. 5, and not on top of the engine as shown in Fig. 4.

Fig. 6 shows the spray valve used with the former system, now obsolete, which follows air injection more or less closely. Fig. 7 shows an enlarged section of the tip end of the spray valve, in which the seat that controlled injection was situated in the tip itself with very little volume between the seat and the orifice. Performance of this entire system depended on keeping this seat tight; but to maintain a tight seat for any great length of time was almost impossible, because leakage occurs when there is the slightest accumulation on the tip. The result of the leakage was that smoke, detonation, irregular loading, and carbon accumulation in the cylinders occurred too frequently to be satisfactory. While constant maintenance by expert operators made it possible to get very satisfactory results, provided a good grade of fuel and oil were used, this alone constituted a serious objection to the common-rail system, an undeserved reputation in the light of subsequent developments that resulted in transferring the fuel mechanism from the heads to a centralized location on the side of the engine. This change, however, made it necessary to perfect means of relieving the pressure on the injection valve between injections, resulting in the development of what is called the atmospheric relief system, which is now standard on these engines. The principle of operation is shown in Fig. 8, which illustrates how the pressure is relieved between injections so that the condition the nozzle itself may be in with respect to incrustations, accumulations, and even wear, is unimportant, for this relief prevents leakage between injection periods.

The injection valve, shown as D in the sketch, is operated by a small push rod, A. Fuel pressure from the constant-pressure header is on top of the valve D at all times. The inlet from the header is shown at E. During the injection period, the valve is lifted by the push rod, permitting the fuel to flow past the valve seat and out through the passage C to the nozzle. During the injection period, it is obvious that the condition of the valve seat plays no part. The end of injection occurs with the seating of the valve. Simultaneously, however, when the valve seats, the push rod end separates from the end of the valve by clearance, as shown. There is a small hole drilled through the end of this push rod that connects with passage B and this in turn is connected to the fuel tank, which is under atmospheric pressure or approximately so. Any leakage past the valve seat between injections must pass through the hole drilled in the push rod, draining back into the tank. As the fuel nozzle is of the closed type, there is no tendency for the leakage to enter the cylinder; therefore, the result is the simplest kind of fuel nozzle, and the fuel pressure cannot possibly be on the nozzle itself at any time except during the injection period. With this system is used a spring-loaded closed-type nozzle, usually of the Bosch type, the same as would be used with the pump injection system. To indicate further the mechanical application of the method shown in Fig. 8, examine Fig. 9, a sec-

Fig. 5. Diesel with fuel-injection pump mechanism centralized on side of engine



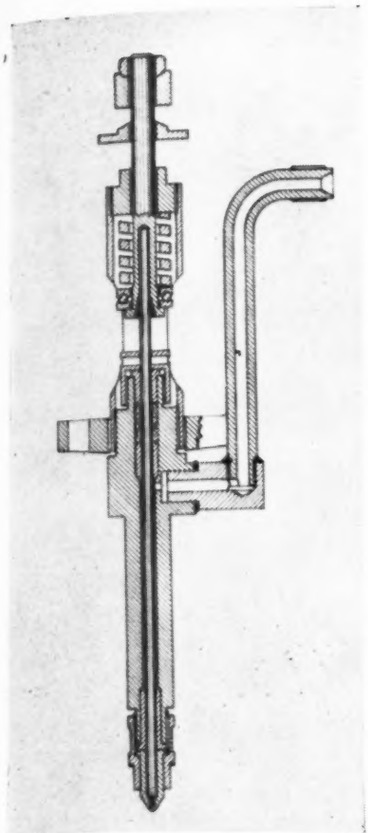


Fig. 6. Section through "EP" spray valve of obsolete type

tion of the actual valve and operating push rod as applied to the latest development of this system.

The chief advantages of this system may be enumerated. It lends itself well to the grouping of the injection valves in a central location on the side of the engine, although not more than four are grouped together, in order to prevent the use of irregular lengths and long runs of fuel tubing to the nozzles. One injection block is used with any number of cylinders up to four, and for 6-cylinder and 8-cylinder engines two blocks are used. The cross-section of this injector block is shown in Fig. 10. In this the valve and push rods of Fig. 9 will be recognized. Fuel enters at a point on top of the injection valve after having passed a small needle valve, which serves as a means of isolating that particular cylinder in the event that it should be desirable to cut off the supply of fuel from the cylinder. After passing the injection valve, the fuel flows past a check valve, and then to the line leading to the closed nozzle in the cylinder head.

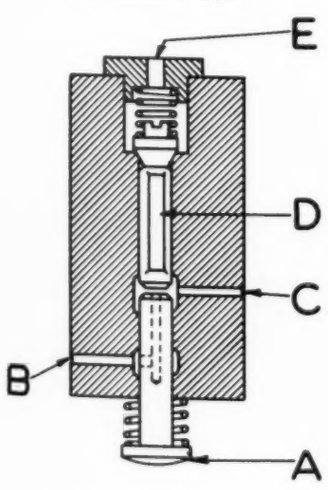
Control is by means of an eccentric shaft that regulates the effective lift of the rocker, which is operated directly from the cam-nose. The camshaft carrying the cams is contained within the unit itself. This makes a compact unit that can be timed and adjusted on the bench and installed correctly with all adjustments properly set. No adjustments whatever need be made on the engine except to see that the drive gear meshes correctly with the gear on the main camshaft.

It will be noted that, though the injection valve itself or any part of the assembly may be easily and quickly removed, the entire injection block containing from one to four units may be removed and replaced when desired, a procedure that is recommended as practical and better than reassembling the unit.

The single-plunger distributing type system is that of the Cummins fuel-injection system. This system employs a single measuring plunger with rotating distributor, which measures the fuel under approximately 100-lb. pressure and delivers it to the injector in the proper cylinder. Fig. 11 shows the diagrammatic layout and the principle of operation. Single-plunger, valveless pump, and a distributor disc, meters and delivers the fuel charge to all injectors alike. The adjustment is set at the factory and is self-compensating for wear, assuring that at all speeds an identical fuel charge will be supplied continuously to each injector. This system is divided into three separate operations. First, the fuel charge is measured or metered at low pressure and delivered to the injector. There it is preheated and gasified by the heat of the compression, and then injected into the combustion chamber.

The injectors are mechanically operated by rocker arms and push rods. The injector is a special casting fitted with a plunger. Mounted on the end of the injector body is a screw cup containing

Fig. 8. Diagrammatic arrangement of atmospheric relief system of modern type



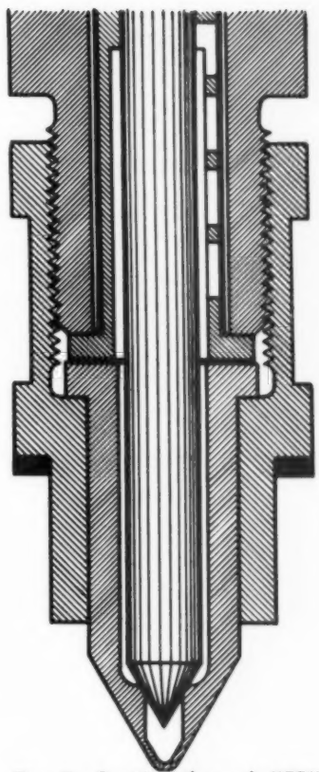


Fig. 7. Section through "EP" spray tip of obsolete type

a small cone-shaped adapter that seats on the end of the injector body. Between the screw cup at the lower end and the cone adapter is a small annular space. A connecting hole to the annular space leads up through the injector body to the fuel line from the pump. This forms a passage from the fuel pump to the annular space in the cup. A series of small holes lead from the annular space to the inner cone and permit the fuel to pass into the injector plunger chamber. On the intake stroke of the engine the fuel-metering pump forces a charge of fuel, of the right volume for the load and speed of the engine, into the annular space between

Fig. 9. Section through "EN" injection valve of modern type

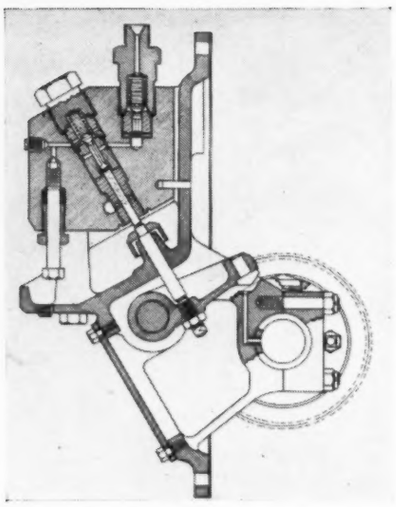
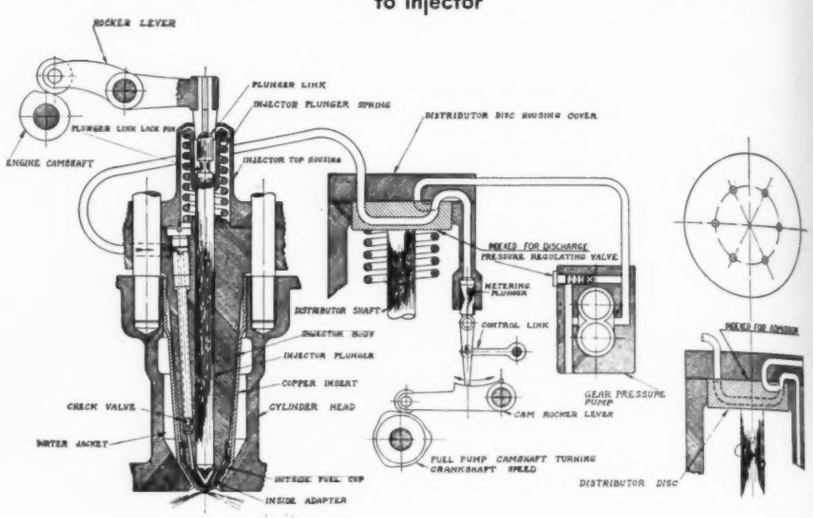


Fig. 10. Section through "EN" injector assembly

the cup and the cone adapter. As the fuel line and the passage leading to the annular space already are full of fuel from previous discharges of the pump, it naturally follows that any fuel added at the fuel metering pump end will push the same volume of fuel into the annular space. This will force the same volume through the small holes in the cone adapter into the inner chamber under the plunger. The fuel lies in this inner chamber throughout the compression stroke of the engine and the heated compressed air is forced through the small spray holes in the screw cup. The oil, being exposed to the heat and blasting of the compressed air, is broken up or gasified. A few degrees before top dead center is reached, the mechanically-operated plunger starts downward and the gasified fuel charge is forced into the combustion chamber where it burns. A small check valve is placed in the lower end of the fuel passage in the injector body to prevent the compression from blowing the fuel back and filling the lines with air.

Fig. 11. Diagram of Cummins method of metering and delivery of fuel to injector



Annual Award of Merit to Be Feature of N.G.A.A. Convention

AN annual individual award for distinctive or meritorious service to the natural gasoline industry, offered by E. I. Hanlon, chairman of the board of the National Bank of Tulsa and of the Hanlon companies, is to be presented each year at the annual convention of the Natural Gasoline Association of America. The convention this year is scheduled for May 19-21, at the Hotel Tulsa, Tulsa, Oklahoma.

While plans for the award are not yet completed and details regarding it still are in the hands of a committee, the board of directors of the N.G.A.A. officially accepted Mr. Hanlon's offer at its meeting here recently. It is intimated, however, that instead of the usual trophy or medal presented for similar service in other industries, a more personal and useful award will be made. A bronze plaque, which will hang permanently in the offices of the association, will carry the names of honored recipients.

Specifically the award might be presented for constructive development or meritorious service concerned with:

1. Research of any kind calculated to stimulate a broader use of natural gasoline or liquefied petroleum products.

2. Manufacturing processes or equipment that would permit greater yield or more economical operation.

3. Test methods and procedure, creation of standards, delineation of specifications, or advancement in laboratory technique.

4. Handling, storage, or transportation of natural gasoline.

5. Marketing of products, gas contracting, accounting, public and industrial relations, safety developments, and any business phase of the natural gasoline industry.

In discussing the award, T. R. Goebel, Shell Petroleum Corporation, president of the association, indicated the enthusiasm with which the directors had endorsed the idea. "It was realized that other industries and professions have had similar awards for years," he said, "and also that men in those fields look on them as coveted honors obtainable only through some outstanding personal service. Most of these awards have been offered by pioneers of the industry and the Hanlon Award will be no exception to that precedent since Mr. Hanlon is one of the earliest pioneers of the natural gasoline industry. Too, we know that the purpose that prompts the offering of this award is only that of assuring public acknowledgment of distinctive service or achievement by openly rendering credit where credit is due. We are deeply grateful to Mr. Hanlon and feel that his award may serve to stimulate personal effort in our own industry as it has in others."

Tentative plans include the immediate solicitation of nominations from interested oil companies, institutions, and organizations by the award committee. This committee consists of T. R. Goebel, president; William F. Lowe, secretary-treasurer; and J. W. Vaiden, chairman of the technical committee, of the Natural Gasoline Association. A five-member advisory committee selected from the board of directors will aid the award committee in making its selection from the nominations submitted.

While the Hanlon Award is to be administered by and presented under the auspices of the Natural Gasoline Association of America, any individual whose service to the natural gasoline industry qualifies him to receive it, is eligible and will be given every consideration.

Joints of cement-asbestos pipe strung along ditch ready for assembly

Corrosion in Salt Water Disposal Lines Obviated by Asbestos-Cement Pipe

An interesting adaptation of composition pipe to overcome a troublesome corrosion problem

By
LEO H. TOWERS

SINCE the opening of the Western Kansas oil area a few years ago the disposal of salt water has been a major problem with producers. Next in importance to determining the place of disposal of this water is the transportation of the fluid from the well to that point. To obviate pipe corrosion, which results in leaks and seepages, many operators have turned to asbestos-cement pipe for salt water lines since its introduction for such use three years ago. During this time more than 125 miles of asbestos-cement pipe has been installed in salt water disposal systems in Kansas and Oklahoma. A lesser amount has been laid in Texas and other oil areas. As salt water is disposed of at the closest possible point, the length of the line in any one system is not great. Seven miles is the maximum length in any system to date, so that the total amount of pipe already installed represents a great many individual systems. Other uses found for this pipe in the industry include lead lines for corrosive crudes, fresh water supply lines to camps, stations, etc., low-pressure acid lines about refineries, and as smoke stacks on pipe line pumping stations.

Though asbestos-cement pipe of the type now used by the oil industry has been employed for many years in water supply systems its first use there also was in the handling of salt water. It was used 20 years ago in Italy, in several cities that installed sea water systems for flushing streets and for fire lines in order to conserve the fresh water supply for domestic use.

Asbestos-cement pipe is made of 85 percent portland cement and 15 percent asbestos fiber by weight. This is equivalent to approximately 50 percent of each by volume. The asbestos fiber has the effect of reinforcing the cement because, being thoroughly mixed with the cement, it has the property of a uniform reinforcement throughout the material. The pipe is made on a rotating steel mandrel on which the cement-asbestos mixture is built up under a pressure of 2000 lb. per sq. inch. The mandrel on which the pipe is made is removed and a temporary mandrel inserted, upon which the pipe remains while taking its initial set. Complete cure is effected by a special curing process.

Asbestos-cement pipe is manufactured in all standard sizes from 2-in. to 36-inch. Joints are 10 ft. in length for the smaller sizes and 13 ft. for the 6-in. and larger. In the field a partial joint of any length can be made quickly by sawing a joint to the length required with a common cross-cut saw. The saw cut will leave a smooth, even face on both pieces of pipe. The pipe is obtainable in four wall thicknesses for each size pipe. These four thicknesses are for the four different working pressures of 50, 100, 150, and 200 pounds. Table I shows some of the typical sizes and pressures with their corresponding wall thicknesses and weights. In density this asbestos-cement pipe weighs approximately 125 lb. per cu. ft. as compared with densities of 450 lb. and 490 lb. per cu. ft. for iron and steel, respectively. Like any cement product the strength of the pipe increases with age. Actual tests on water supply lines in service for 17 years show an increased strength of 43 percent.

Line coupled in ditch ready for backfilling

The first installation of asbestos-cement pipe in the Mid-Continent fields was in a refinery at Arkansas City, Kansas, three years ago. Near Leon, Kansas, an operator has used cement pipe for his lead lines handling corrosive crude for more than two years without any trouble.

Laying of an asbestos-cement line in the field is simple and can be done without experienced labor. A crew of three or four men working behind a ditcher can lay 400 ft. of 3-in., 4-in., or 6-in. pipe in an 8-hour day. In addition to the laying crew three or four additional workmen are required to backfill and tamp the soil around the pipe, giving it a cover of about 2 inches. The rest of the backfilling is completed the same as is any other pipe line job. Though the joints are

Lever type jack ready to pull coupling over rubber rings to complete joint. Note that the opposite end of the pipe is used as the fulcrum for the lever bar

TABLE I

Showing some typical sizes, dimensions, and weights of asbestos-cement pipe

SIZE (inches)	DIAMETERS		WALL THICKNESS (inches)	WEIGHT PER FT. (lb.)	WORKING PRESSURE (lb./sq. in.)
	EXTERNAL (inches)	INTERNAL (inches)			
2	2.82	2.00	.41	2.80	100
4	4.94	4.00	.47	5.94	100
6	7.24	6.00	.62	11.60	150
6	7.36	6.00	.68	12.90	200
8	9.50	8.00	.75	18.70	150
8	9.68	8.00	.84	21.20	200
12	13.96	12.00	.98	36.40	150
24	28.30	24.00	2.15	159.00	150

coupled, a positive seal is afforded by the coupling. The facility with which the pipe can be laid is due to its light weight and short joints. For example, a 13-ft. joint of 6-in. pipe of average pressure weighs approximately 130 pounds. Two men can handle such a joint with ease, even to lowering in the ditch.

Economical installation of an asbestos-cement pipe line is also made possible by the speed with which joints can be coupled together. Pipe may be coupled on skids over the trench and then lowered, but preferably the work is done in the trench where no additional room is required. Each joint is equipped with an asbestos-cement coupling and two rubber rings. By placing the two rings at positions on the pipe that have been factory-marked, and pulling the coupling over the rings a bottle-tight joint is made. To force the coupling over the rings, a flange known in the field as a "horse collar," and fastened to either a hand or hydraulic jack by means of chains, is placed behind the coupling, and a constant pull exerted on the coupling; thus the coupling is pulled over the rubber rings, and the rings rolled into their final position. The accompanying sketch shows a cross-section through a joint with the coupling pulled over one ring. Note that the interior wall of the coupling is beveled to facilitate forcing it over the rings. To take up the line the coupling puller can be applied to the sleeve, forcing it over the rings again, and thus renders the line 100 percent salvable.

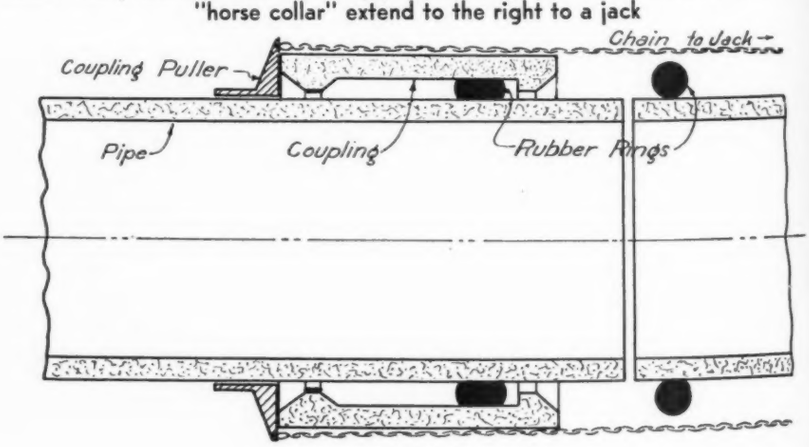
The flexibility of this type of joint permits the line to follow the contour of the trench and also provides for sweeping bends. It provides also for expansion and contraction, as well as taking care of any settling that may occur in the bottom of the trench. The rings also act as shock absorbers to any vibrations on the pipe. It has been laid along railroad rights-of-way and even suspended across railroad trestles with no trouble resulting from train vibrations.

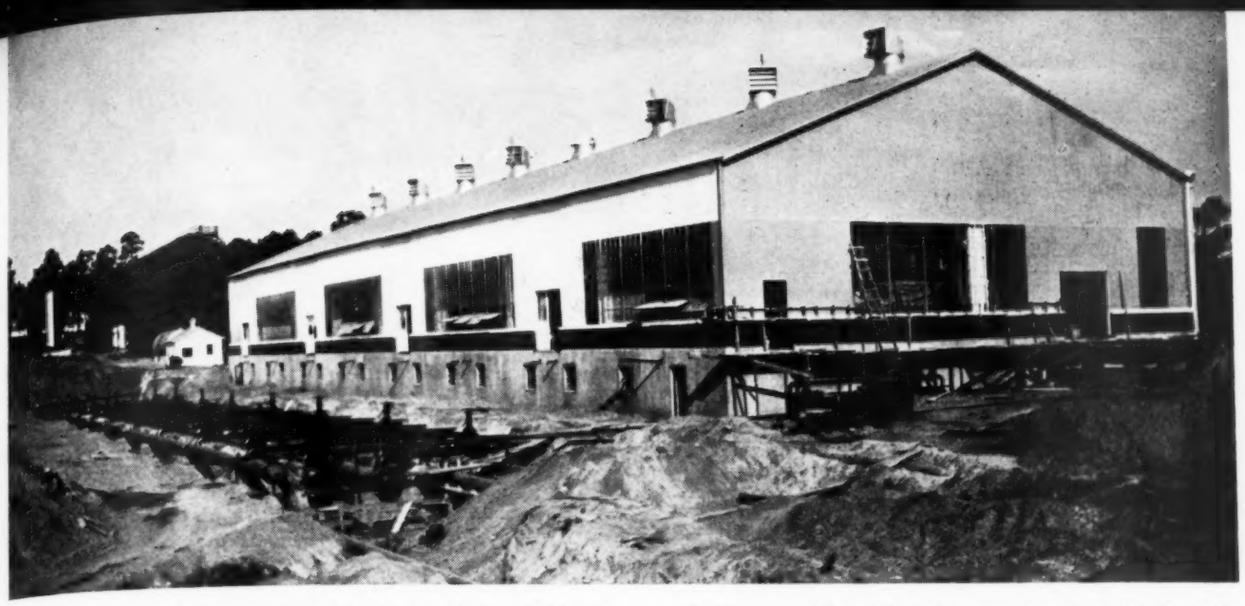
The rings, made of 75 percent pure rubber, when compressed between pipe and coupling form a water-tight joint that appears to last indefinitely. There are many installations of rubber rings in municipal water lines that have been in service from 35 to 50 years and have experienced no leaks through the rubber rings. Rubber protected from light, heat, and air, as these rings are, is not subject to oxidation and deterioration. What effect oil will have on these rings is not yet known definitely, but it is the opinion of engineers who have watched the results so far that a chemical action may give the exposed rubber a coating that will prolong its life.

Asbestos-cement pipe, being nonmetallic, is free from tuberculation, a chemical reaction between water and the metallic elements of pipe that results in deposits on the pipe walls. This is of particular importance in salt water disposal when the salt is returned to an underground sand. It is necessary that suspended materials be limited to a minimum in order that the face of the sand will not become clogged. The lack of chemical reaction will prevent to a large extent the settling out of solids and result in maintaining the original effective area of the pipe and also in preventing clogging of the sand pores.

Asbestos-cement pipe is limited in its applications in the oil industry to lines under 200 lb. pressure; however, for salt-water disposal and "sour" crude lead lines it is being used in increasing amounts.

A cross-section through a half-completed coupled joint. The ring on the left is under compression between the pipe and coupling. Chains fastened to the "horse collar" extend to the right to a jack





Compressor station in Rodessa field of United Gas Public Service Company while still under construction. At the left can be seen a portion of the underground piping before it was covered

Compressor Stations for Natural Gas

Advanced engineering shown in design of those recently erected

By ROY W. PARKER
Oklahoma Natural Gas Company

GAS requirements the past winter were greater than in previous years. During the year just ended there were 16,500,000 gas consumers, of which 6,324,000 were served with natural gas. Gas deliveries totalled 1,234,000,000 M cu. ft., an increase of 195,490,000 M cu. ft. over 1935. Should these deliveries increase as expected, gas company officials agree that a major construction program will be required in 1938.

Compressor stations being a very important unit in the transportation and delivery of natural gas likely will be an important item in future developments. Many stations handled capacity volumes last season; however, provisions were made in original installations for additional units, and lines always can be paralleled to provide for larger volumes.

A review of published information concerning the Panhandle Eastern Pipe Line Company's transmission system to Detroit and compressor stations enroute reveals this to be one of the major pipe line projects in recent years. For that reason the design and operation of these stations are of general interest to the gas industry. Seven new stations having a total of 26,000 hp. were added. The three original stations and the new ones are at Liberal, Kansas, capacity 7000 hp.; Louisburg, Kansas, 5000 hp.; Glenarm, Illinois, 4000 hp.; Stinnett, Texas, 2600 hp; Greensburg, Kansas, 3900 hp.; Haven, Kansas, 3900 hp.; Olpe, Kansas, 3900 hp.; Houstonia, Missouri, 5200 hp.; Centralia, Missouri, 3900 hp.; and Pleasant Hill, Illinois, 2600 hp.

These are orthodox stations but advanced engineering ideas incorporated in their design give them certain features that cause them to differ from usual station plans. Buildings are of the usual structural steel, covered with asbestos—cement corrugated siding and roofing. Main units in all new stations are 24 in. by 36 in., 1300-hp. twin tandem; compressor cylinders are of 15-in. diameter equipped with 1150-cu. in. unloader valves. The mechanical units in the station have been installed and interconnected so as to provide maximum flexibility in present operations and minimum delay if additions are made.

The four stations in the "dust bowl" country are air-conditioned as a means of minimizing maintenance cost, promoting better working conditions, and assuring continuous service. This equipment, designed and installed by the Fluor Company, conditions the air both in summer and winter. In the hot and dusty season the air is water-washed and distributed to the inside in sufficient volume to maintain a pressure differential of ½-in. water pressure between the inside and outside of the station. The engine exhausts are cooled by pulling cooled air around them. When operating as a heating system, cold air

Electrical-generating plant at United's Rodessa compressor station

Circulating pumps at the Oklahoma Natural Gas Company's station in the Quinton, Oklahoma, field

is forced by a blower between the warm exhaust and an outer casing, heated and returned through a system of ducts to the station building.

To minimize freeze-ups from condensation in the lines a gas dehydration plant has been built on the outlet side of the Liberal, Kansas, station. It is a calcium chloride brine circulating system. A gasoline absorption plant capable of producing 40,000 gal. of gasoline under peak load conditions completes the gas-conditioning installations at this station.

The United Gas Public Service Company completed in the Rodessa field of Louisiana a new 2-stage compressor station in November, 1936. This plant is among the largest of its type in the United States and is capable of handling 60,000 M cu. ft. of gas daily. The compressor units, auxiliary equipment, piping, etc., all conform to the latest design and practice. There are eight 1000-hp. engines that receive the gas at a pressure of 50 lb. and boost it to 450 lb., before it goes to the Myrtis gasoline plant to be processed.

This plant is being enlarged and will utilize considerable of the distress gas in the locality. As is the trend in compressor station construction, provision has been made for the installation of four additional units when needed.

To facilitate the operation of its transmission system under an increasing load the Oklahoma Natural Gas Company erected a booster station in the Quinton, Oklahoma, gas field last fall. Withdrawals in this locality have been approximately 50 billion cu. ft. the last seven years and the rock pressure has declined about 50 percent from the original 525 pounds. The station is capable of handling approximately 25,000,000 cu. ft. daily, the gas entering at a pressure of 150 lb. and being discharged into the main line at 325 pounds.

The engine room has four 230-hp. single-stage compressors with 7½-in. by 20-in. cylinders. Each engine, of the 2-cycle type with economizer, has two clearance bottles, one fixed and one adjustable. The engine water is cooled by a cooling tower designed to handle 460 gal. per min. from 100 deg. fahr. to 90 deg. fahr. at 70 deg. fahr. wet bulb, 60 percent humidity and five miles an hour wind velocity. Two pumps circulate the water, each capable of handling 500 gal. per min., at a 60-ft. head. Two gas engines drive two 18-kw. generators for energy requirements. A 5½-in. by 3⅛-in. by 3½-in. 2-stage compressor unit is used for starting air. This station, even though it is small compared to some of the large units, has incorporated in it all the modern practices in station construction.

The Central States Power and Light Corporation has erected a 1290-hp. station in the Carney area of the Quinton field. Seven units, five 190-hp. and two 170-hp. engines have been installed. This station can handle 30,000,000 cu. ft. a day at pressures of from 125 lb. to 400 pounds. Provisions were made in the original installation so that 1000 hp. additional can be added.

In constructing this plant officials of the company have been motivated by a desire to erect an up-to-date and efficient station. The piping is aboveground, all joints are electric-welded with web re-inforcements. Engine air is taken through cleaners and the fuel gas is scrubbed. Engine exhausts are air-cooled. The air is jetted around the exhaust by the explosion of the fuel charges.

A steam boiler carrying 15-lb. pressure supplies steam for radiators and winter heating. Two Ford V-8 gas engines drive 3-phase generators in the auxiliary room. A 1½-kw. light plant also is installed for any emergency. Storage batteries would light the auxiliary room at any time.

This station is under automatic control in all respects: engine temperature and oil levels, starting air pressure cut-off, boiler water level, etc.

The Cities Service Gas Company erected a small 3,000,000 cu. ft. station near Wellington, Kansas. This ties into the 20-in. and 10-in. main lines from Oklahoma and Wichita. Gas enters this station at a pressure of 10 lb. and is boosted to 100 lb. by three compressor units, each of 320 horsepower. Piping and equipment are arranged to allow for three additional units when needed. This station was completed December 18th.

Compressor station engines may be called upon to develop higher pressure some time in the future. One Eastern company is experimenting with pressures of 1000 lb. and higher, whereby smaller pipe can be used, investment reduced 25 percent, and larger volumes handled because of gas super-compressibility.

In the meantime many gas companies probably will find it necessary to make additions to their present installations or construct smaller auxiliary units in individual fields.

Central States Power and Light Company's Quinton, Oklahoma, compressor station

Safety Device for Internal Combustion Engines Equipped with Layshaft and Electric Ignition

By JESSE G. GIBSON*

THE usual "shorting" device on internal combusion engines "shorts" the ignition to the spark plug and causes the engine to stop. Should the engine governor be defective or fail to function, the engine instead of stopping may develop such excessive speed as to wreck itself.

Usual engineering practice is to place a spring-loaded plunger mechanism at or near the flywheel rim. If for any reason the engine exceeds a given speed limit, the excessive centrifugal force exerted by the plunger overcomes the tension of the spring and causes the end of the plunger to come in contact with the stationary trip mechanism; this shorts the ignition from the spark plug, causing the engine to decrease in speed—and finally stop.

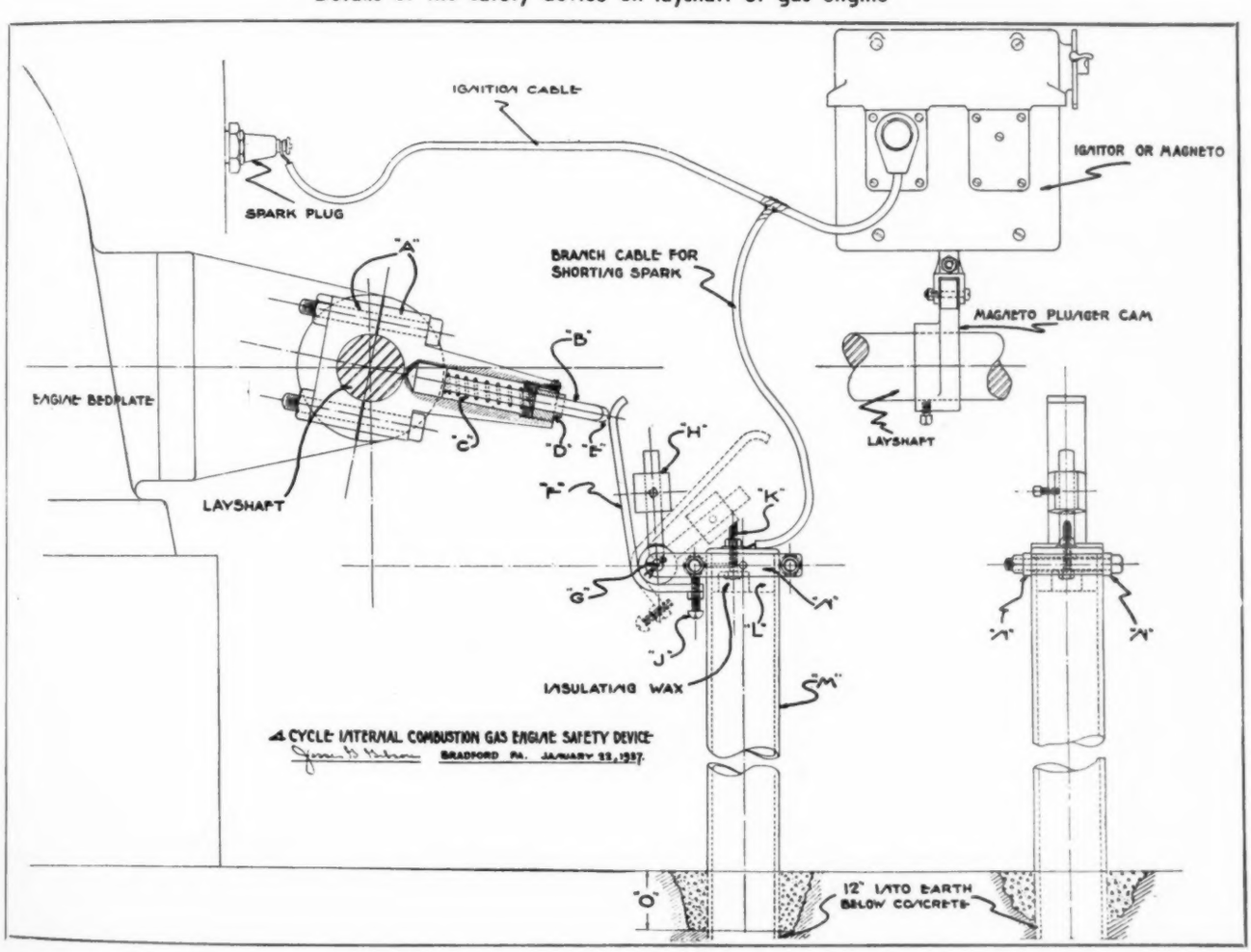
A survey of prime movers in use in the various oil fields reveals that almost 90 percent of all horizontal engines up to 50 hp. are started manually. It has been the contention of the writer that for all engines the above-described position of the revolving portion of the shorting device is extremely dangerous. The wearing apparel of those starting the engine may come in contact with the plunger mechanism of the shorting device, thus endangering life. Regardless of how good a "housekeeper" the operator happens to be, engine room floors sometimes are quite slippery and this increases the hazard.

Though the safety device shown in the accompanying illustration was designed originally for use on 4-cycle engines, it also is adaptable for use on 2-cycle engines equipped with a layshaft. This appliance has double safety features. It not only protects the engine against possible damage but it also protects human life.

Ignition shorting devices are not unusual on engines of recent design, but to the writer's knowledge only one manufacturer has incorporated the

*Chief Engineer, The Sloan and Zook Companies and the Bradford Producing Company, Inc.

Details of the safety device on layshaft of gas engine



plunger mechanism feature on the layshaft. This was done at the insistence of the writer, who explained the dangers that might be encountered by the conventional mounting of the plunger mechanism on or near the flywheel rim.

The accompanying illustration shows the plunger device mounted on the layshaft. Any position on the shaft will serve the purpose if it is out of the operator's way and inside the guard rail that protects the engine.

An ignition shorting device in any form also is important to safety from another angle. Flywheels will fly to pieces when operated beyond certain speed limits. Many lives have been snuffed out by flying fragments of ruptured flywheels. Such accidents may be eliminated when the engine is equipped with a shorting device in proper working order, for the engine will be stopped long before the rupturing point of the flywheel is reached.

An explanation is here given of the operation of the device shown in the accompanying illustration and proposed and used by the writer for engines not equipped originally with such a device.

The plunger device is a split casting (A) that clamps over the layshaft without disturbing the setup of the layshaft. The plunger (B) is mounted in the casting (A) and is under spring control (C) through spring nut (D). Under normal running conditions plunger (B) extends as shown in the full black lines. The spring is so adjusted that when the engine reaches any predetermined desired speed, say 50 r.p.m. above the regular operating speed, the spring tension is overcome by the centrifugal force acting on the plunger and protrudes from the casting (A) as indicated by the dotted plunger lines (E). The protruding plunger makes contact with the arm (F), which is carried on a fulcrum pin (G). Integral with this arm is another arm carrying the weight (H). The position of the arms (F and H) are adjusted through the set screw in (H) and the set screw (J) so that these arms are slightly overbalanced to the point that the extending plunger with very little effort trips the arms into the position shown in dotted lines. As this occurs the weight (H) makes contact with screw (K), which is set in the best insulating material (L) obtainable. The insulating material for block (L) should be of the best because the ignition cable is run through a branch cable that is clamped to the screw (K) as shown. As the voltage is 10,000 and the amperage 1.5, an average for good high-tensioned magnetos, obviously it is very desirable that the insulating block (L) be of high quality insulating material. If the insulation is poor, the spark will be carried by the branch cable from the magneto through the screw (K) and puncture the insulation through to the pedestal pipe (M), which will act as a grounding element, as will be described immediately. It will be noted that the assembly of the arms (F) and (H) through the fulcrum pin (G) are carried on the clamping members (N). These members (N) are clamped to the pedestal (M), forming the ground, by extending into the earth to bedrock below the concrete (O) that holds the pedestal (M) securely in place. When the weight (H) comes in contact with the screw (K), as explained, it will be noted that through the clamp parts (N) securely clamped to ground pedestal (M) the spark from the magneto is shorted to the earth, forming the perfect ground. The spark is thereby cut off from the spark plug and this causes the engine to decrease in speed and finally stop; thus the engine is prevented from "running away."

WHAT "OCTANE" MEANS*

ALL tests performed on gasoline have a definite purpose; that purpose is service to the consumer. One of the most widely used and probably the least understood of these tests is that which designates the octane number of a motor fuel. The term, "octane number," is rather simply explained. It comes from the fact that in making this determination the fuel being tested, which is of unknown value, is compared directly to a fuel of known value that is based on blends of iso-octane and normal heptane. These two products are selected because of their wide difference in knock characteristics, and, as they are pure chemical compounds, they readily can be reproduced. Arbitrarily, an octane number of 100 is assigned to iso-octane, and an octane number of 0 is applied to normal heptane. Therefore, if these two fuels are blended in any given proportion, the exact percentage of octane used in the blend is known and the fuel is described as having that octane number; or, if we may use a little red school house arithmetic, suppose a blend of 70 parts iso-octane and 30 parts normal heptane were made, the fuel has a rating of 70 octane—And there goes another myth completely exposed!

The word, "octane," in this regard is nothing more nor less than a unit of measurement, the same as an inch or a gallon. We all know what an inch represents or what a gallon represents. Likewise, a given number of octanes indicates a definite and precise measurement of the tendency of that fuel to knock.

The octane number of a fuel is a numerical figure taken from an arbitrary scale that indicates the tendency of that fuel to "knock," "ping," or "spike" when used in a motor car. As a usual thing, we can say that, all conditions being equal, the higher the octane number, the less that fuel tends to knock. For example, if two fuels are selected of, say, 70 and 77 octane number, the higher octane fuel would burn more slowly and therefore would be less apt to knock.

The test is made on a piece of apparatus known as a C.F.R. engine, these cryptic initials meaning Coöperative Fuel Research, which is the name applied to a committee that jointly represents the Automobile Manufacturers Association, the American Petroleum Institute, the National Bureau of Standards, and the Society of Automotive Engineers. The knock engine is nearly as large as its name. It is an imposing-looking piece of equipment about 2½ ft. wide, 5 ft. long, and 6½ ft. high. The engine itself is of a single cylinder, 4-cycle, internal combustion type and has a head that can be raised or lowered, thereby changing the compression ratio. These engines are checked daily for mechanical condition, and at regular intervals samples are sent to all laboratories of the company and several outside of the company, where tests are run and the operation of all engines checked and correlated.

*From an interesting article, "The Smiths Bluff Refinery Laboratory and Gasoline, with a Word About Octanes," by C. W. Cooper, Smiths Bluff Refinery Laboratory, and Thomas H. Risk, Northfield Laboratory, *Pure Oil News*, January, 1937.

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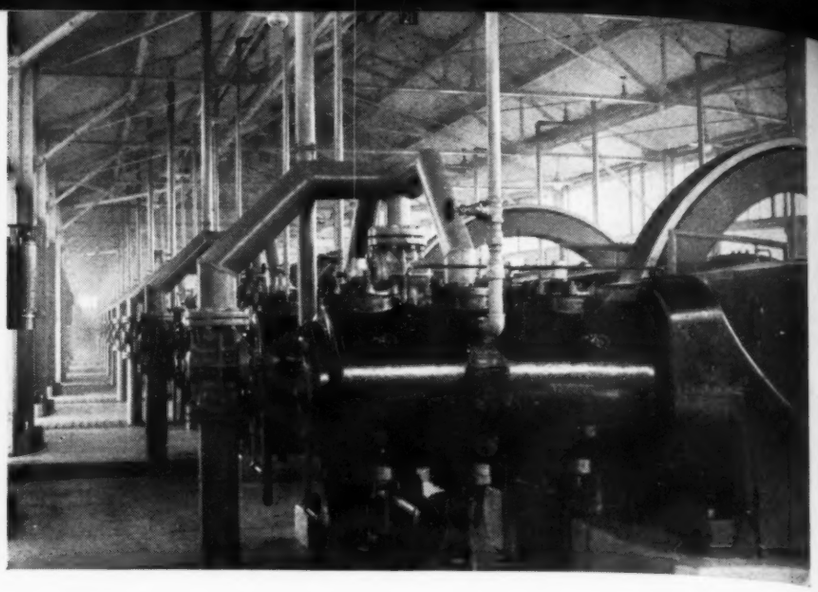
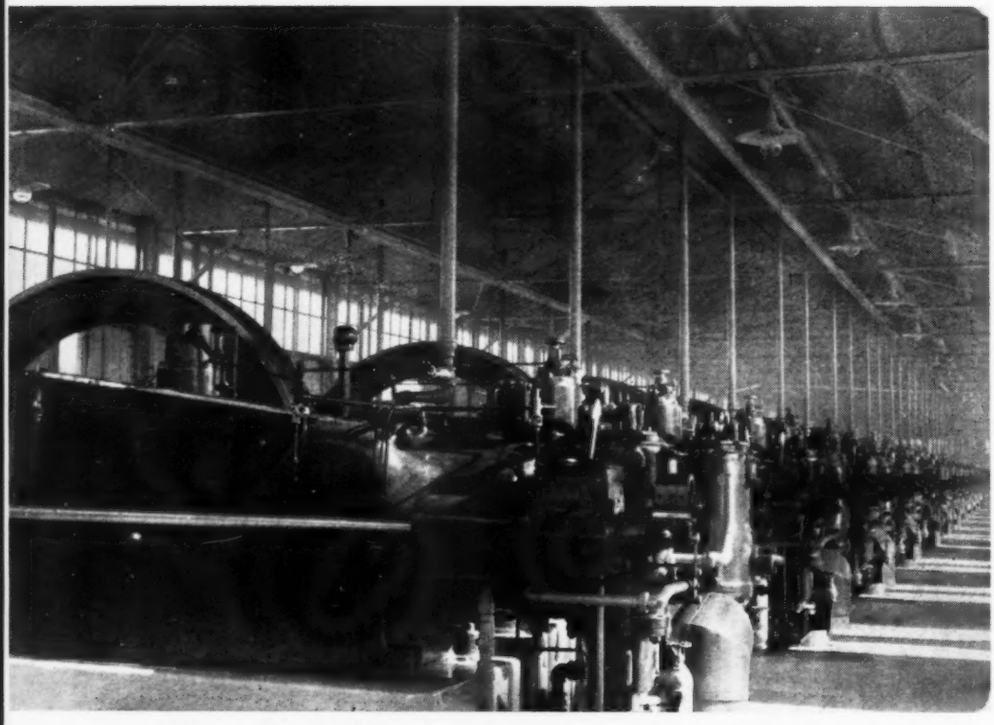


Arrangement of intake lines and position of plug valves in gas compression plant of Industrial Fuel Supply, at Dominguez, California. Water return lines from cylinders are carried overhead

Efficient Engine Cooling-Water System



Interior of Industrial Fuel Supply Company's plant at Dominguez, California, showing the overhead water-cooling lines on the 22 compressor units that boost 30,000,000 cu. ft. of gas from a pressure of 30 to 300 pounds

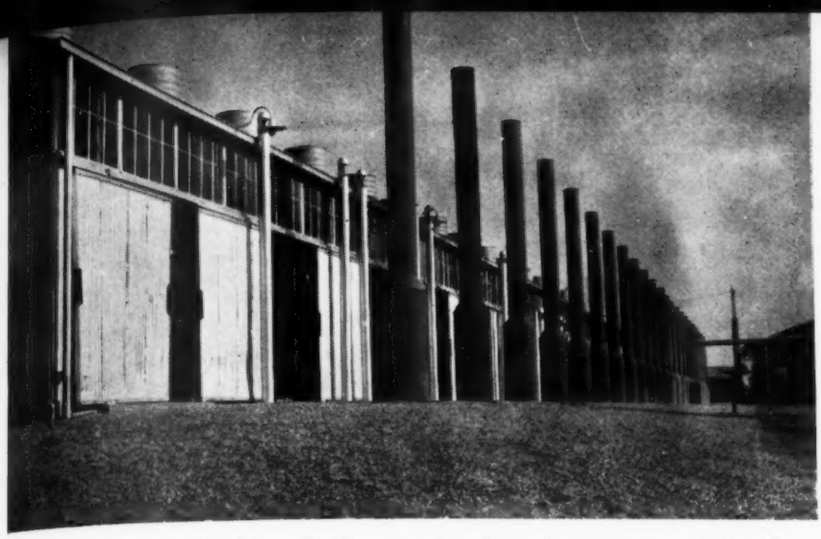
Overhead installation of cooling-water header in gas compressor station has marked operating advantages

PLANT No. 13 of the Industrial Fuel Supply Company in the Dominguez field near Long Beach, California, has been extended several times to care for surplus gas produced by the Union and Shell oil companies. Particular attention always has been paid to the method of handling engine jacket water at this plant. Ample provision was made when the plant was constructed for the addition of several twin compressors as needed.

Water used for cooling the jackets of the compressors and power cylinders of the engines enters the jackets under pressure. Instead of flowing out through the usual connections into an underground return line to a hot well, the water flows upward to an overhead discharge header that leads back to the louvre tower cooling-water basin. This practice not only eliminates an underground reservoir, but also makes it possible for the usual jacket water circulating pumps to handle the water cold, instead of hot, when it flows to a so-called hot well.

The lines leading from the circulating pumps are laid in concrete-lined conduits on both sides of the building, covered with grating inside and wood outside, the covering serving also as part of the plant's walk system. The ordinary type of entrance connections

(Continued on Page 63)



Exterior of Industrial Fuel Supply Company's enlarged compressor station for gas transmission from the Dominguez field. Fluor air-cooled exhausts are used on the engines

(Continued from Page 60)

are attached to the engines so the water will flow from the lower side of the cylinders to the outlet at the top, but 2-in. pipe lines carry the water from this point upward to the headers, which are carried on the steel roof trusses.

Connections to these overhead water headers are not made directly in the lower side of the pipe, but overhead by passing the individual lines above them with two ells returning downward for attaching to welded nipples in upper side. Gate valves are placed in each water discharge line, with ground joint lip unions between the gate valves and the outlet from the water jackets. By connecting individual lines to the headers, water may flow through the headers to the louvre tower, even when connections have been broken down with the gates open.

Another advantage is claimed for this method of handling water, in addition to the elimination of an elevated supply tank and hot wells. The water enters the side of the cooling tower at such a height that partial cooling is obtained before it is picked up again by the usual type of circulating pumps to be distributed over the top of the tower.

"Mike" Ford, superintendent of the compressor stations of the Industrial Fuel Supply Company, states that by installing cooling-water headers in this manner, a considerable saving in power has been accomplished, and that the temperature of the water is sufficiently low to reduce the temperature of the gas and engines to a satisfactory degree.

Nation's Proven Oil Reserves Placed at 13 Billion Barrels

PROVEN oil reserves of the United States on January 1, 1937, are estimated at 13,063,000,000 bbl., according to a report submitted to the board of directors of the American Petroleum Institute by the Institute's Committee on Petroleum Reserves. This is an increase of 886,000,000 bbl. over the estimate of these reserves as of January 1, 1935. During this two-year period the committee calculates that 2,044,000,000 bbl. were produced; but discoveries of new pools and development of old ones have covered this and added 886,000,000 bbl. to proved reserves.

Further, the committee says that its latest calculation of reserves is so conservative that it probably will have to be revised upward as further developments take place. That was what happened two years ago, when the estimate as of January 1, 1935, placed proven reserves at 12,177,000,000 barrels. Later the figure was raised to 13,632,000,000 bbl. when more complete data on new discoveries became available.

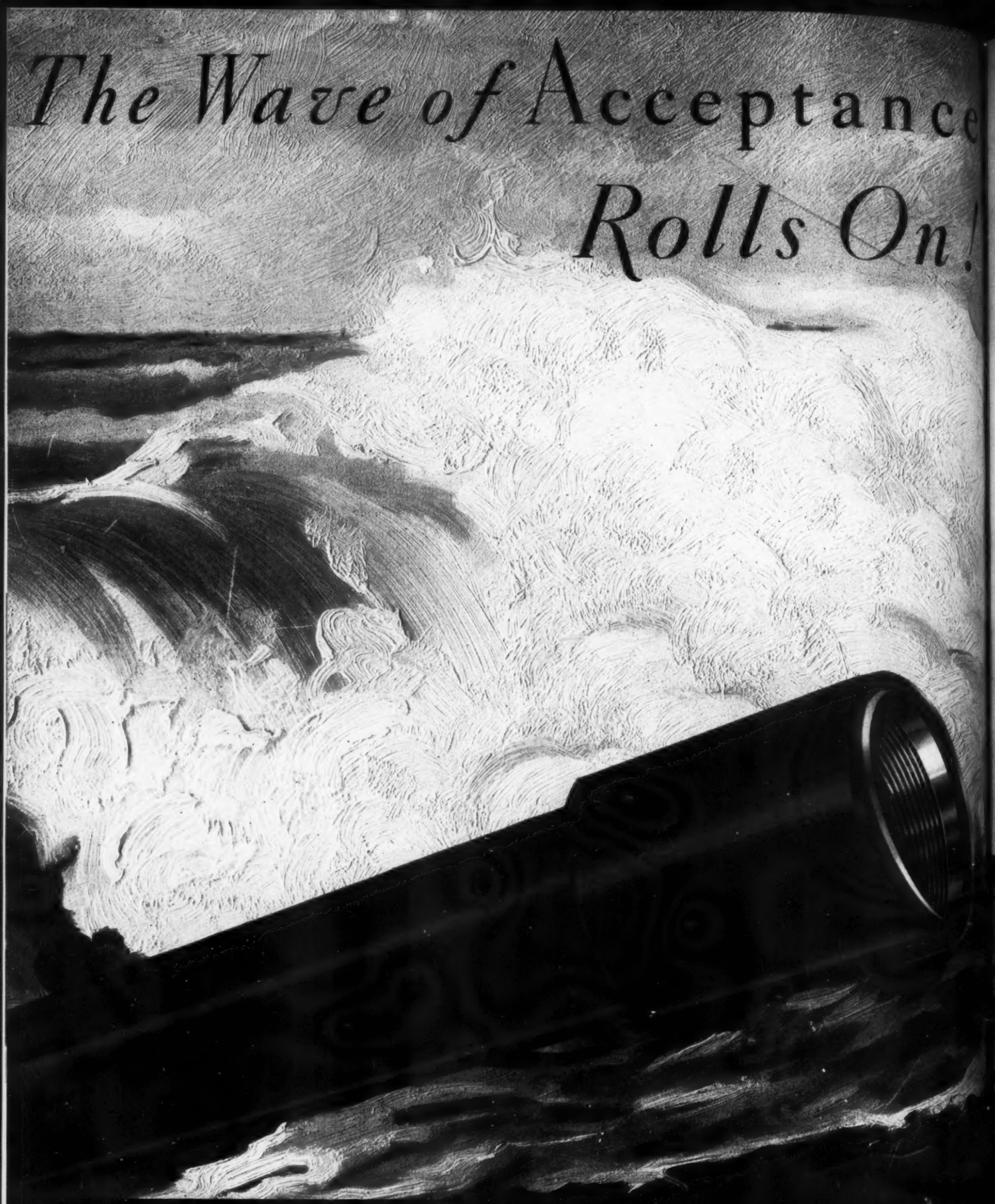
Commenting on the report, President Axtell J. Byles, of the Institute, said the estimate must be understood to deal only with "known and proven" reserves.

"It takes no account of possible—indeed, certain — future discoveries," he explained. "The figures do not mean that the country has available only 13,063,000,000 bbl. of oil, but that it has proved reserves up that amount. The Chicago wheat pit estimates of 'visible supply' of wheat do not include calculations of next year's crop; and likewise these petroleum estimates take no account of future findings of oil. They are calculations of what we *know* we have.

"The probability is that these proven reserves constitute only a small portion of the supply that will be made available. But these reserves do assure that there is no imminent danger of shortage. The known and proven reserves of today will be supplemented by new discoveries, as in the past. Beyond this there is the definite knowledge of many possible substitutes, obtainable by known processes and in substantially inexhaustible quantities, at reasonable prices. Also, there is the certainty of larger recoveries of oil from the earth by reason of continuous improvement in recovery methods."

The committee pointed out that it considered all available data on production and discoveries in 1935 and 1936 and had studied carefully the record of developments during those years. Estimates of reserves by states, as of January 1, 1937, gave Texas 6,422,000,000 bbl.; California 2,956,000,000 bbl.; Oklahoma 1,141,000,000 bbl.; the Rocky Mountain states—Wyoming, Montana, and Colorado—346,000,000 bbl.; Kansas 568,000,000 bbl.; Louisiana 524,000,000 bbl.; New Mexico 471,000,000 bbl.; Arkansas 84,000,000 bbl.; and the eastern states —Pennsylvania, West Virginia, Ohio, New York, Michigan, Kentucky, Indiana, and Illinois—551,000,000 bbl.; making a total of 13,063,000,000 barrels.

J. Edgar Pew of Sun Oil Company, Philadelphia, Pennsylvania, chairman of the Committee on Petroleum Reserves, said he believed in view of the thorough assembly of data, and of the coöperation the committee had received from many petroleum geologists and engineers, the report was the most accurate presentation that had ever been made on the matter of reserves. Other members of the committee are: Wallace E. Pratt, Humble Oil and Refining Company, Houston, Texas; W. B. Heroy, Consolidated Oil Corporation, New York; G. Clark Gester, Standard Oil Company of California, San Francisco, California; R. F. Baker, The Texas Company, New York; Frank Clark, The Ohio Oil Company, Tulsa, Oklahoma; Fred E. Wood, Standard Oil Company (Indiana), Chicago; and F. H. Lahee, Sun Oil Company, Dallas, Texas.



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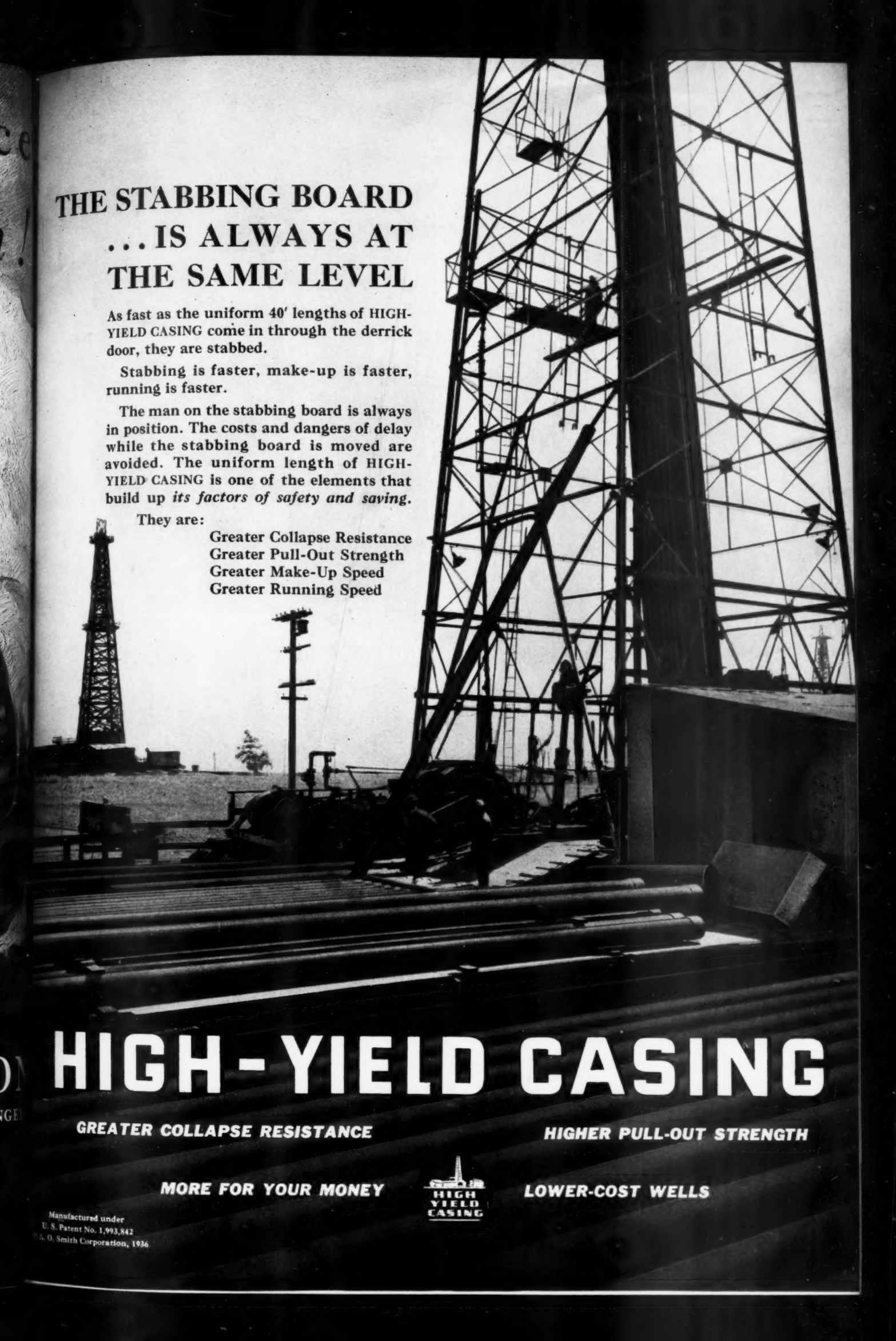

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The Oil Deluge

Production finally was curtailed— but how about the cost?

By CAMPBELL OSBORN

THE flood of crude oil that swamped the producer shortly before the great business depression and has continued to harass him in varying degrees of intensity since that time was no surprise to some oil men. There was little pinched-in potential production in 1926 and stored oil had declined. They knew that $2.00 oil would stimulate the search for new fields. The progress of geologic knowledge during the preceding decade was no stranger to them. They had heard the geologist and geophysicist talk about old shore lines, buried mountains, and diastrophism—broad terms these—and a few had the lurking suspicion that entirely new oil regions would be found by these scientists and that in the future pools would be discovered in groups. That is precisely what happened.

The details of the great oil deluge and of its effects upon the producer are well known. Some have passed into history along with many an old-time oil man. But most of these things are still interesting because many producers that lived through the storm have not yet fully recovered, and because a review of the causes and effects of the last oil depression may point to some conclusions that will be helpful in reducing the shocks of the next.

The First Downpour

For many years the clouds had been gathering on the horizon. In early 1926 they loomed up noticeably. With advanced prices the number of new wells started monthly promptly rose from about 900 to 1200 and a large proportion of them were wildcats. Thereafter thick and fast were events in the crude oil world.

No longer were the oil man and his scientists content with drilling in the older areas or with the discovery of mere single pools. Before the ink was dry on the first increased price schedules of 1926 Seminole had been found, and additional and geologically-related pools soon were added to the now Greater Seminole District. A few months later, in southwestern Texas, far away from previous oil production, followed Yates and Hendricks.

These were no ordinary fields. In less than two years the Seminole district was producing more than one-half million bbl. a day and the Hendricks pool a quarter of a million. In three years after its discovery Yates reached a daily production of 100,000 barrels.

Look to the left of the accompanying picture on page 68 of oil conditions since 1925. Off went the lid from new supply in late 1926. Something had to be done. It was decided to prorate production, but despite all efforts to curtail the output, flush production to the amount of nearly a million bbl. daily was added within a few years to the current national supply. Stocks mounted at an alarming pace; and no one knows how much was the pinched-in potential production.

In the spring of 1927 the average price of oil dropped to $1.25 a barrel. Not so easily, however, was the law of demand and supply to be satisfied. Consumption had grown, but the oversupply, actual and potential, was tremendous; moreover, the fruit from years of research had not yet been fully garnered. Scientific forces continued to work overtime, unwisely it seems now, and if at times fewer test wells were drilled, those that were put down were more intelligently located.

For four years the average prices were pegged at figures slightly above or below $1.25 a barrel. Proration and low gas-oil ratios kept much potential production from a glutted market, but when prices were strongest new drilling increased, the proved reserves grew, and little was done to curtail the efforts of science. Excepting the cost of production, always a feeble factor in the price of crude oil, there was every economic reason for a more drastic price decline; but none was immediately forthcoming, the surplus production continued to be curtailed or tanked, and new pools kept coming in.

The Great Overproduction

In 1930 the storm burst forth in all its fury. Prolific Oklahoma City, discovered two years before, by this time had grown to amazing proportions. The wells were deep and expensive to drill and the cost of production high, but their initial yields were large and they had remarkable sustaining powers. As at Seminole, there was no market for all the oil that could be produced, and production was curtailed. Though the compilers of current supply figures could not count the curtailed potential, the law of demand and supply was none the less counting it to be used later against the oil men. No longer could the inevitable price debacle be postponed.

Look again at our chart of oil conditions on page 68. Despite curtailed production, down went the average price to 89 cents in late 1930, the lowest figure paid for crude oil since the Cushing overproduction 15 years earlier; but this was not to be the end, and it remained for East Texas to deliver the final blow.

Never in the history of Mid-Continent petroleum were there as great finds as at Joiner, Kilgore, and Longview, Texas, in the latter part of 1930 and in 1931. The wells were not so deep as at Oklahoma City. They could be drilled rapidly with the rotary rigs now in use nearly everywhere; and their number was legion.

The production curve of this area rose like a rocket. Fifty thousand bbl. a day was a mere drop in the bucket. A hundred thousand was passed in a few months. There was no hesitation even at a quarter of a million. Before long the daily production exceeded a half million bbl. and stayed there until 1933, and the area was credited by some oil men with a potential open flow equal to all the current production elsewhere in the United States. East Texas was a new major oil region, discovered, largely drilled, and brought to eronmous proportions in less than 365 days. Though, as at Seminole and

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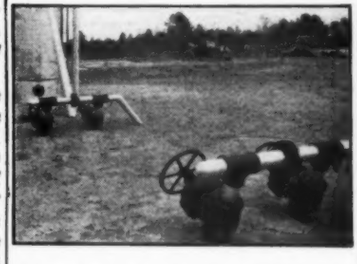

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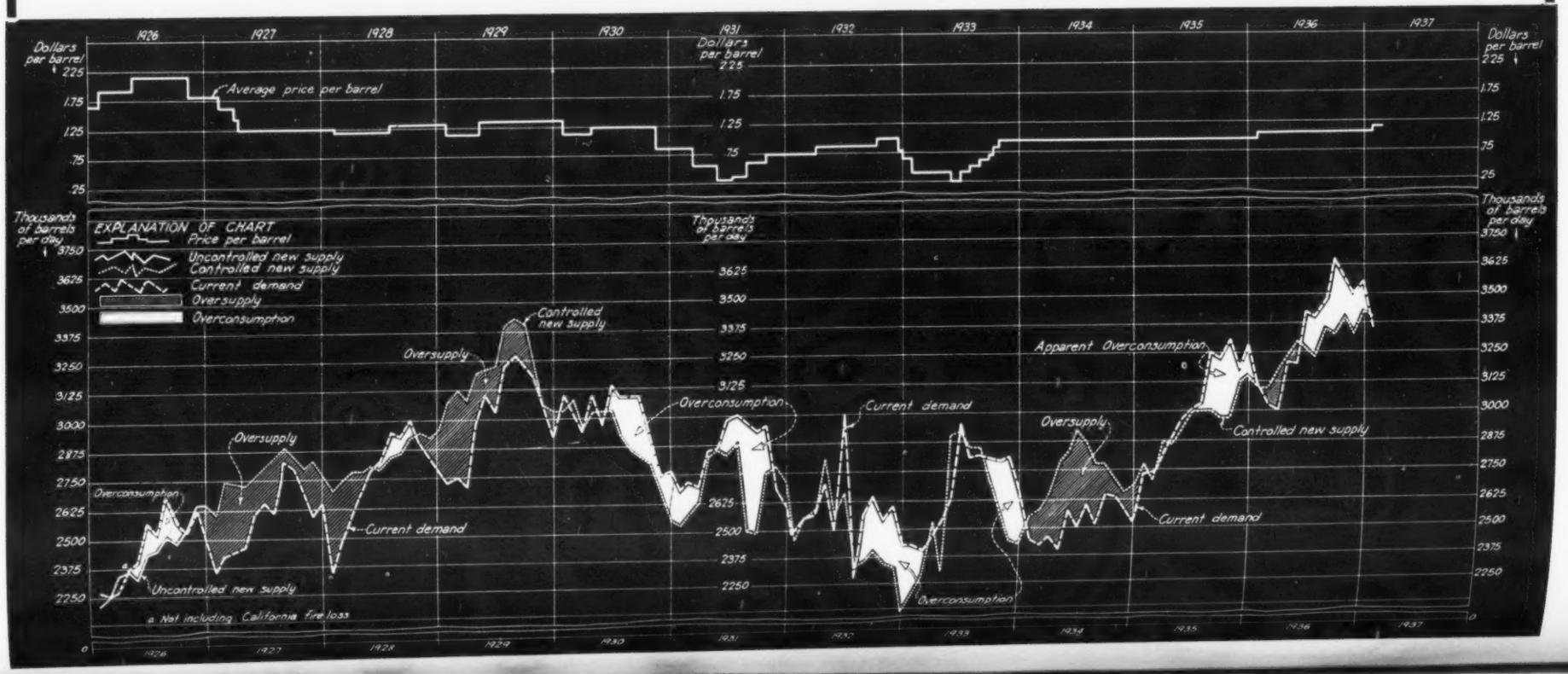
Crane has grown up with the oil industry and knows its problems from earliest wooden derrick days to the present era. Crane has been solving "hot spot" problems since oil men first used that term. Our research engineers for years have been busy finding metals that would handle safely the temperatures, pressures and corrosive problems of the industry.

Crane makes valves and fittings of forged steel, cast steel, malleable iron, special alloys, cast iron, brass. Every metal is treated as a specialty at Crane although it may have long been used in a regular line of Crane valves for generations. That's one reason why Crane valves and fittings are tops in the services for which they are recommended. CranEquip wherever you need a valve or fitting. It's the easy way to stop your valve trouble.

Oil Demand, Supply, and Prices



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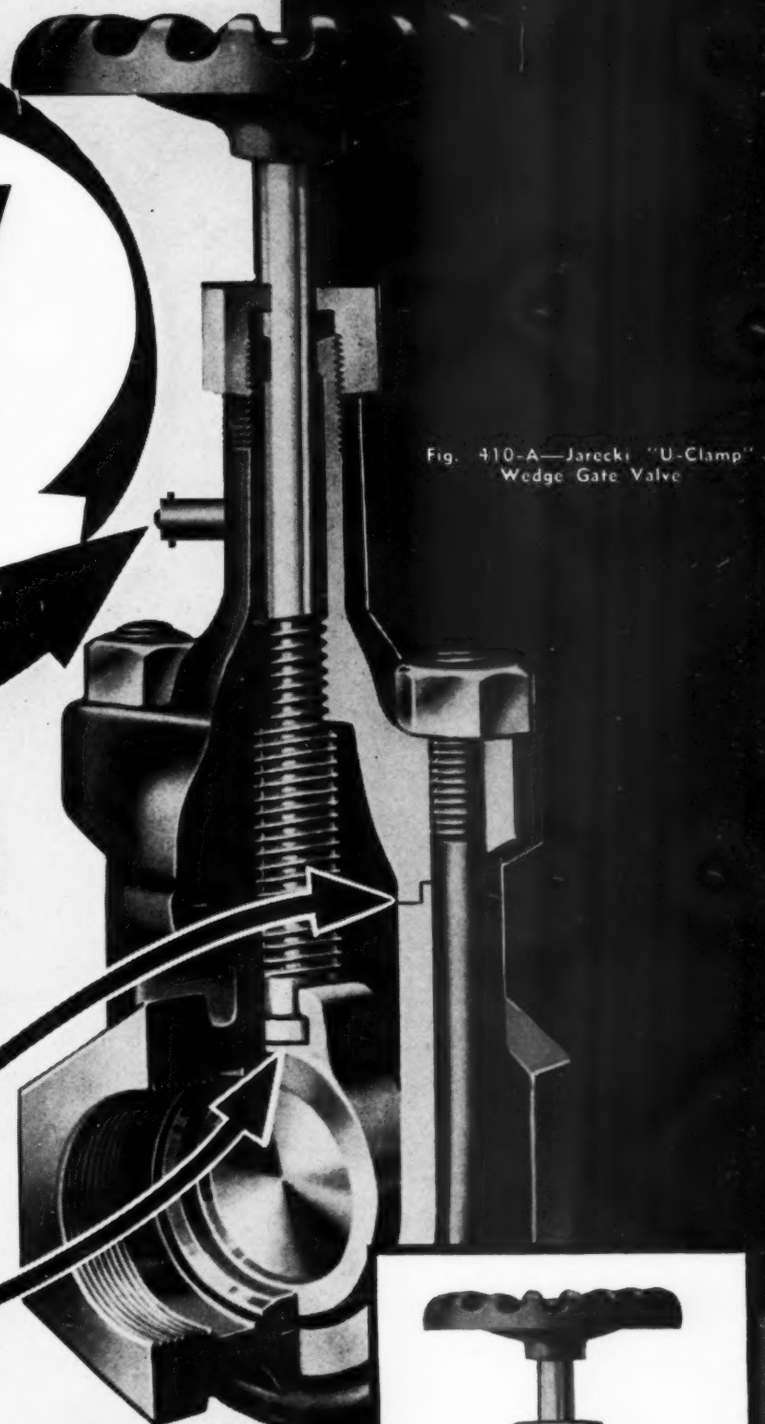

Fig. 410-A—Jarecki "U-Clamp" Wedge Gate Valve

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JARECKI "U-Clamp" Valves also offer these valuable mechanical features:

1. Recessed circular joint between bonnet and body with lead gasket, provides a leak-proof joint and prevents packing from creeping or blowing out.

2. Wedge-guides in body prevent rattling of wedge and insure positive closing regardless of position of valve.

3. "U" Saddle bonnet attachment equalizes pressure on bonnet gasket and facilitates taking apart or reassembling valve.

Steam Working Pressures: 150 pounds for ½"-2"; 125 pounds for 2½"-3". Oil, Water or Gas Non-Shock Working Pressures: 225 pounds for ½"-2"; 175 pounds for 2½"-3".

We invite you to see the JARECKI lubricated "U-Clamp" Gate Valves at our nearest oil country store.

See JARECKI Section, 1937 Composite Catalog

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Oklahoma City, the flow of oil from these new Texas pools was necessarily curtailed, there was little hesitation in drilling them and the national supply curve only partially revealed their economic effect.

No longer could the voice of demand and supply be muffled. Prorated, the enormous production at Oklahoma City and East Texas could be counted on for years and the bottom promptly fell out of petroleum prices. Costs meant nothing. Twenty-five cents a barrel in 1933 was the lowest posted figure for oil of average grade, but much distress petroleum was sold at lower prices.

Economic law had been in abeyance. The price cuts were postponed too long, and the longer sound price changes based on the current relation of demand to the actual and potential supply were put off the more inevitable they became and the more drastic they had to be.

The producers of course were completely demoralized by this debacle. Geologists and geophysicists by the hundreds lost their jobs. Finally, after the new fields had been developed, drilling became mere routine. Well done had been the work of the oil finder and his good and faithful scientist. There was enough oil in sight to last America for half a decade. Science and the drill had at last been silenced.

Prior to 1927 there was comparatively little pinched-in production in the United States. Several years earlier a few fields had been curtailed temporarily in California and back pressure had been used at Salt Creek, but the curtailed pools were economically far removed from the great centers of consumption. Hence until 1927 current production accurately reflected the volume and trend of the full supply. There was something that could be readily measured and compared with demand. Oil men and economists knew what the supply was and there was some accurate way of determining what the price should be. But not so after that year, and unhappily not so even today; and so far as the writer knows no systematic effort is now being made to compile complete authentic data showing the amount of oil that profitably can be recovered from the proved reserves.

The Period of Recovery

Since 1929 surface reserves of crude oil have been greatly reduced and bottom-hole pressures have declined. Fitts and Conroe have been discovered and developed, but they have not been large pools, and drilling at Kettleman Hills has been well controlled. As our chart on page 68 illustrates, there has been current overconsumption throughout most of these seven lean years, but it has not been real shortage and weak has been the price response when cost per barrel is considered. The big problem has been to absorb the excessive but unknown pinched-in yield. Engineers have shown the economy of back pressure in some fields, and this has helped reduce the supply in barrels of profitable production.

Years have elapsed without the development of a market-breaking pool. Largely idle for five years, science has pointed the way to no new fields of great promise except Rodessa. Time is required to build a scientific organization and assemble necessary detailed technical information; but the work of years may be destroyed by its dismemberment. No one knows how long will be the time until the oil finder can regain his former stride.

As the proved underground and surface reserves have been absorbed there has been some recovery in prices and with it in new drilling. At last the producers are again receiving a little over $1.00 a barrel for oil of average grade. New drilling has grown to predepression levels. Though many producers are still in the red, their gloom has changed to hope, the scientists has been re-employed, and the search is on anew.

The Cost of Production

No one knows what it costs to produce the nation's petroleum. Many studies have been made, but the oil business changes rapidly and often before the data are published they are obsolete. Though the cost of lifting has been reduced by better engineering practice, deeper and deeper goes the search for new fields and higher the average cost of completed wells.

Is all the money that goes into search and production the cost of the oil supply? If it is, petroleum production is unprofitable. Studies made by the writer in past years of what went into it and came out and of the value of what was left, indicated a deficit of not less than 50 cents for each barrel produced. Average lifting costs for the most settled production at that time, small in proportion to the whole but most dependable, were not far from $2.00 a barrel. Much of the supply was produced by companies not dependent upon crude oil for profits, and new money was being attracted from outside the industry. In these respects production has not essentially changed.

Petroleum production is a highly speculative enterprise in which only the fortunate few make money. People seem ever ready to risk large sums on the long chance for good profits. The high prize of success continues to attract new wildcatters. Public money is constantly poured into holes in the ground. The new wildcatters and high cost producers frequently must refinance or give up the struggle and quit the industry as others enter to take their place. A less speculative industry could not thus attract new capital.

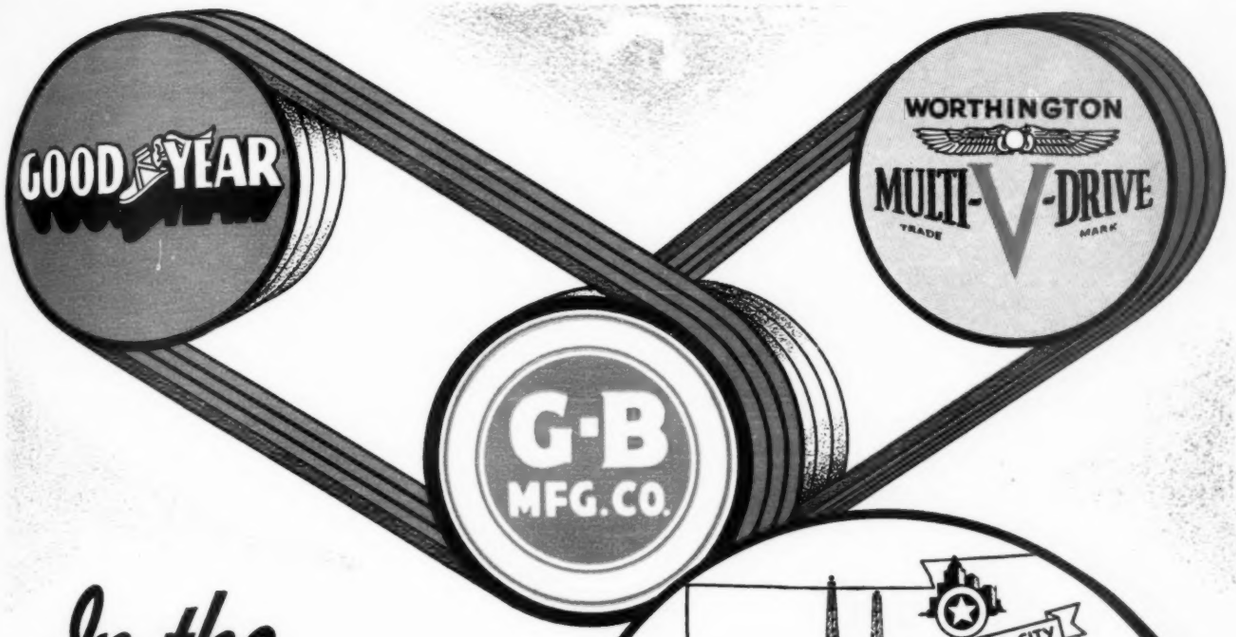
In the oil business, as in other industries, there are, of course, high-, intermediate,- and low-cost producers, but unlike other industries high cost producers and wildcatters periodically are driven from it. If a producer can keep his costs extremely low he stays in the industry and enjoys profits. Rarely does the new wildcatter recover his capital and the high-cost producer makes money only at top prices. The producer of the middle class makes good profits when prices are high and breaks even or loses money when they are low. From time to time producers shift from one class to another as their relative proportions of high- and low-cost production change.

While not a dominant price factor, cost of production affects the supply in some degree. If prices long remain below average costs, as they did during the recent depression, the high-cost producer stops leasing and drilling, his production of course declines, and his property passes to stronger hands. The same thing is true, but to a lesser extent, of the middle class producer. He may hold on by reducing his expenses, curtailing operations, and abandoning wells so depleted that pumping costs exceed current prices. Thousands of wells of low yield are abandoned for this reason during periods of overproduction. The low-cost producer may, of course, go on increasing his output indefinitely until oversupply forces the price below his costs. When this occurs there is a sharp decline in the national production.

Control by Proration

As the oil producer looks back over the great deluge that swamped him after 1926, proration, gas-oil ratios, and price cuts stand out boldly in the dismal picture. Which of these things helped and which hurt him? What was it that brought supply under control? Did proration do it? Was it the final drastic price cut? What benefit did he get from better well spacing and the wiser use of gas in lifting oil? No one can be sure that his answer to these questions is correct; nevertheless they must be replied to by the industry, and the way in which they are solved collectively will determine the future course of oil.

There can be no doubt that proration ultimately reduced the current



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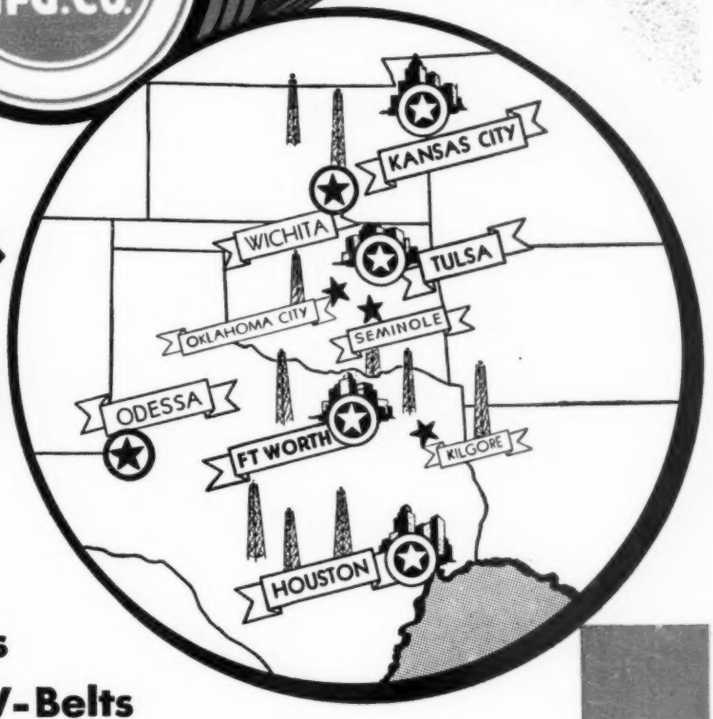

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output below demand and lowered surface stocks. Both were constructive results. There can be no doubt that proration, bolstered by the interstate hot oil law, focused attention upon better production practice. Oil thus was conserved and losses reduced. But did proration stem the tide of drilling? It did not! Did proration stop the search for unneeded fields? It did not! It took price cuts far below the cost of production to do these things. Did proration prevent the price of oil from going to depths that ruined hundreds of producers? It did not! Oh, in many ways oil proration is a good thing and it is here to stay, but it leaves much to be desired; and the producer pays the bill.

In some respects proration has been harmful. If the price of oil had been cut drastically when Seminole was discovered would Oklahoma City and East Texas have been found at the time they were? Had the last big cuts not been so long postponed would they have been so deep and would prices have stayed down so long? Probably not, will be the answer of the average oil man. Is there not something that can be added to proration so that the ruinous cuts in price and the other hardships it imposes on the producer can be avoided in the future?

Severe as has been the punishment taken by the crude oil producer during the depression, there is a bright side to the picture. Constructive good always comes from great economic crises. The vast improvements made by engineers in drilling and producing practice have not been all. The oil man has been taught a great economic lesson, and proration helped him learn it.

Periodic estimates of the future demand for oil now are made by the United States Bureau of Mines, and these estimates are used by state oil regulatory bodies and by the Oil States Compact Commission in arriving at the allowable production of each state. Though states may withdraw from the compact confederation and the Bureau of Mines' recommendations are purely advisory, the plan has worked fairly well, and for a long time production has been kept in reasonably good balance with demand.

Who knows what the next move will be? Will it be to forbid withdrawal from the compacts and to make the recommended production binding? Permanently stabilized supply commensurate with demand is certainly a desideratum. There are many economic and legal reasons that can be urged both for and against such moves. Will some plan be devised that will hold back unnecessary drilling and the discovery of unneeded and undesirable new pools? There also are many legal and economic arguments both for and against such a plan. If all these things should be accomplished and the plans work smoothly still the millenium would not be here, for the producer is entitled to a price high enough above cost to allow him a fair profit. Many are the economic reasons against price fixing, and some students of this problem find an equal number for it, and there are constitutional obstacles. Space does not permit a detailed discussion of these matters here. But no man can escape the conclusion that it is not fair forever to saddle the producer with the cost of controlled production.

MAKING AN "OCTANE" TEST*

THE procedure in making an octane test is briefly as follows: The octane number of the fuel to be tested is estimated and a blend of iso-octane and normal heptane is made to that estimated figure. For example, let us suppose that the information given to the tester is that the fuel is 65 octane material. He will then make a blend of 65 parts of iso-octane and 35 parts of normal heptane. The fuel to be tested and this blend just made are placed in separate tanks of the C.F.R. engine (Coöperative Fuel Research) that feed through individual carburetors. The knock characteristics of each fuel are indicated on the knock meter, a device mounted on the instrument board of the engine, which indicates the knock tendency of each fuel being tested by showing a variation of knock intensity. If the blend made and the fuel being tested are widely different, a new blend is made using that difference as a guide to determine the percentages of iso-octane and normal heptane to be used in the new blend. It is necessary in the procedure of testing a fuel that the fuel being tested be bracketed; that is to say, one of the blends of known fuel knocks a little worse than the fuel being tested and one of the known fuels doesn't knock quite so violently as the fuel being tested. We then have three fuels on which we have an indication of knock characteristics as shown on the knock indicating meter. Let us assume that the blend we made that knocks more violently than the unknown sample was composed of 69 parts of iso-octane and 31 parts of normal heptane. It is rated at 69 octane. The blend that knocks less violently than the unknown fuel was composed of 71 parts of iso-octane and 29 parts of n-heptane. It is rated at 71 octane. We know the octane number of the one that knocks most because we made it. We know the octane number of the one that knocks least because we made that one also. The one in the middle, as is usual with anything in that position, is now helpless and gives up the secret of its octane rating by a simple mathematical calculation and interpolation. The precise number, which is the octane rating of the fuel, may be determined to within one-tenth of an octane.

What is all this fuss and hubbub and to-do about octane numbers anyway? Why are they important; what do they mean; and what effect are they to have on our good friend, the customer?

If a fuel knocks in an automobile, several things happen. First, a disagreeable sound, annoying and nerve-racking. Second, a distinct loss of power because not all of the fuel is being ignited progressively. Third, the motor runs hot. This is hard on the bearings, the lubricating oil, and the temper of the driver.

*From an interesting article, "The Smiths Bluff Refinery Laboratory and Gasoline, with a Word About Octanes," by C. W. Cooper, Smiths Bluff Refinery Laboratory, and Thomas H. Risk, Northfield Laboratory, *Pure Oil News*, January, 1937.

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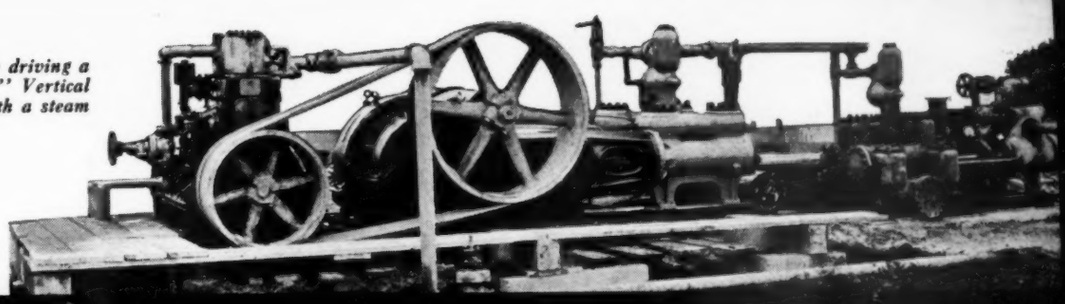

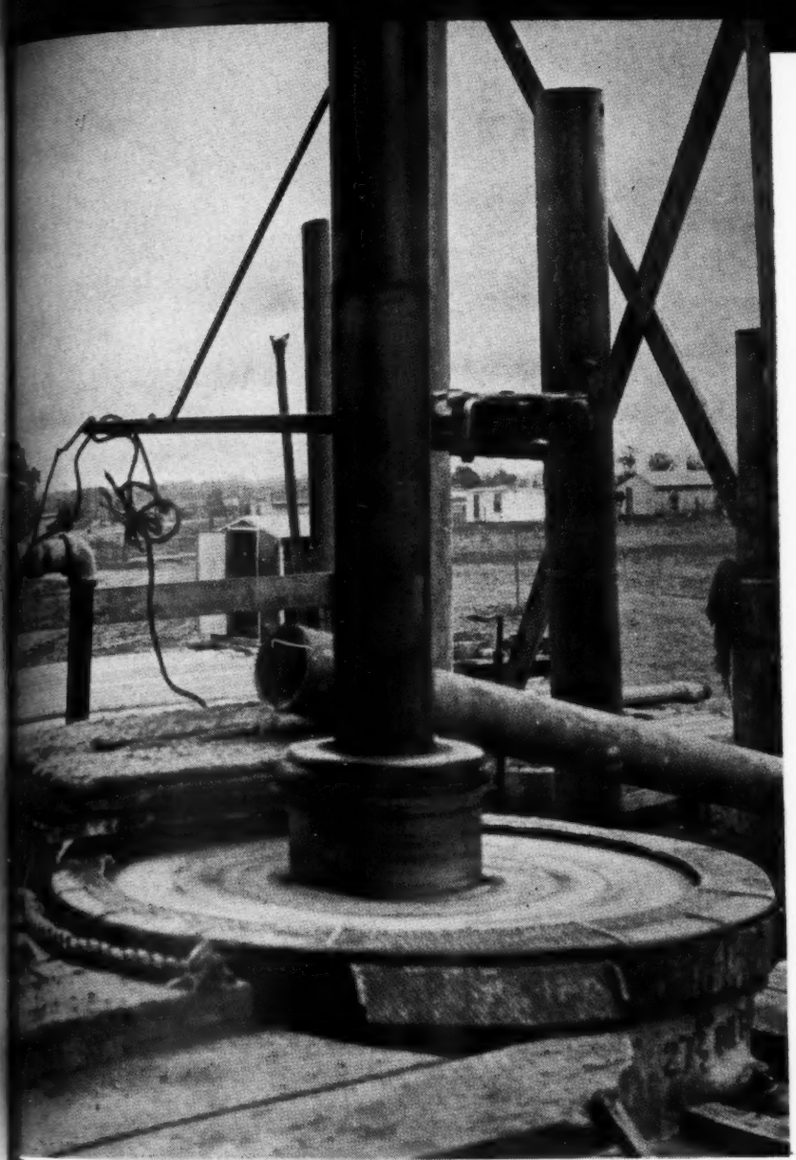

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Quantitative Determination of Adulteration of Lubricating Oils by Means of Identifiers • • Part 4

By S. FISCHER, JR.

PHENOLPHTHALEIN-Hexalin—Methyl Red—Pyridin Identifier. The stock solutions of both these identifiers have been described under the individual identifiers.

Treatment of a 2000-gal. batch of oil: Introduce into a suitable blender 2000 gal. of oil to be treated. Agitate and heat to 120 deg. fahrenheit. While heating progresses prepare the methyl red-pyridin solution as recommended under the treatment of a 2000-gal. batch with this identifier. When 120 deg. fahr. has been reached introduce this identifier. Now add 224 cc. of the phenolphthalein-hexalin indicator as recommended under the individual indicator. Agitate and continue heating until the temperature reaches 150 deg. fahrenheit. This should require approximately 30 minutes. The oil is then ready for market. All precautions for the combined indicators are to be followed as given under the phenolphthalein-hexalin and the methyl red-pyridin indicators.

Identification test for adulteration: Into two separatory funnels place 15 cc. each of the plant-treated unadulterated oil and of the oil under suspicion respectively. To each funnel add 15 cc. of ether. Shake until mixed. Add 15 cc. of the hydrochloric acid test solution used for the methyl red determination, as previously described, to each funnel and shake for ten minutes. Allow to separate or centrifuge and draw off the bottom layer, which will hold the methyl red, giving a reddish-pink color. Continue as described under the methyl red-pyridin test. The results are quantitative.

To the oil-ether extracts left in the funnels add 15 cc. of the test solution used for the identification of the phenolphthalein in the phenolphthalein-hexalin identifier and follow the directions as there described. The results obtained colorimetrically for the adulteration are quantitative.

In order to obtain this double check it is essential that the procedure be followed in the above-described manner and sequence, as the reversal of the operation will yield only one color, namely, yellowish-pink. This yellowish-pink coloration, provided the correct filters are used in the colorimetric determination, is itself quantitative, but yields only a single, quantitative result.

Legally, however, the reversal of the operation for the identification test is of paramount value. Assume a person to have adulterated the producer's oil and such claim is made in court before a jury. The person against whom the adulteration claim is made meanwhile has found that phenolphthalein produces such a pink color as claimed by the owners of the process and shows this to the jury. As is well known, phenolphthalein in acid solution is colorless. All the producer of the Fischer Identified oil would have to do is to ask for the extraction liquor produced by the party who adulterated the oil and claimed the pink color as his own. The producer then would make this extraction liquid acid and the color of the solution would disappear. Then he would take his own oil and extract with the extraction solution used for the phenolphthalein-hexalin identifier. He would obtain a yellowish-pink color very much like the phenolphthalein color. To this he would then add acid to make the solution acid and instead of a colorless solution, his color would still be pink. This would settle matters in his favor before any jury.

This certainly is true camouflage. The writer has produced oils, in which the phenolphthalein and the methyl red content were of such amounts that the continuance of the pink color in alkaline and in acid solutions was practically constant. In other words, the methyl red color being so faint as practically to match the pink color of the phenolphthalein.

Some results demonstrating the efficiency of this identifier combination will prove of value. (See Table 8.) This identifier in every way is as efficient as the first combination, provided the treated oils are stored in metal containers, as the methyl red is not stable in sunlight. All advantages and disadvantages of the individual components hold true in the combination, with the added advantages of a double check on the adulteration plus the best camouflaging for legal purposes.

The cost of this identifier is slightly less than that of the Oil Brown M-Phenolphthalein combination, being $0.00034 per gal. of oil treated as against $0.000477, respectively.

The Triple Identifier. Undoubtedly the perfect identifier combination is what the writer terms the "Triple Identifier." This is the combination of the Phenolphthalein-Hexalin, the Oil Brown M, and the Methyl Red-Pyridin identifiers. The "Triple Identifier" is the most powerful one both from the angle of legal guarantee and difficulty of detecting the individuals.

TABLE 8

Results Using Methyl Red-Pyridin and Phenolphthalein—Hexalin Comp'd Identifiers

1	2	3	4	5	6	7	8
Made up Samples		% R.T.O. determined in Terms of		Av. % R.T.O. F and M.R.	Av. % Error R.T.O. Col. 1 and 5	Approx. % R.T.O. Det.	Approx. % A.O. Det.
% R.T.O.	% A.O.	F	M.R.				
10	90	12.71	11.84	12.28	+2.28	10	90
15	85	14.20	72.90	13.55	−1.45	15	85
40	60	39.75	38.32	39.04	−0.96	40	60
85	15	84.70	86.21	85.46	+0.46	85	15
90	10	89.36	89.56	89.56	−0.54	90	10
100	0	102.75	102.75	100.64	+0.64	100	0

ABBREVIATIONS:
R.T.O.—Refinery Oil Treated with Methyl Red-Pyridin, Phenolphthalein-Hexalin Identifier.
A.O.—Oil Used for Adulteration. F—Phenolphthalein. M.R.—Methyl Red.

GIVES YOU MORE TIME TO GET IT DOWN

● When the hole is deep and temperature's high—and trouble starts to pop—that's when you'll appreciate the *extra time* Unaflo gives you! Unaflo sets slower, yet hardens quickly after initial set—forms a tight shut-off against gas and water.

In Oklahoma there is a Johnson Sand well that produces about 1500 barrels of gross fluid per day on gas lift, cutting approximately 98%. It was decided to try to plug off water in this well by attempting to force quantities of thin cement slurry into permeable streaks in the sand, and then remove the cement from the hole.

Thirty-five sacks of Unaflo were pumped into the seven-inch casing between two rubber plugs. Pressures up to 2400 pounds were used. Here's a record of the time:

Mixed 35 sacks	**22 minutes**
Pumping cement in casing	**4 minutes**
Put in follow plug	**7 minutes**
Pumping plug to 6,245 ft.	**5 hrs. 5 min.**
Total Time	**5 hrs. and 38 min.**

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1. Gives you more time to get it down.
2. Remains a fluid suspension longer.
3. Follows irregularities of well bore and casing.
4. Hardens thoroughly with high density after it is placed.
5. Displaces contaminating elements in the well.
6. Not stiffened by mud contamination.
7. Not stiffened by salt water contamination.
8. Sets satisfactorily in sulphate water.
9. Requires no ice.
10. Makes squeeze and plug-back jobs easier, surer, more successful.

U-11

USS

UNAFLO

FOR SAFE DEEP-WELL CEMENTING

TABLE 9

Results Using the Triple Identifier

1		2	3	4	5	6
Made up Samples		% R.T.O. Determ. in Terms of			Av. % R.T.O. F.—O.B.M. and M.R.	% Error in Terms of R.T.O.
% R.T.O.	% A.O.	% F.	% O.B.M.	% M.R.		
10	90	12.50	11.24	10.79	11.51	+1.51
50	50	51.04	50.88	48.51	50.14	+0.14
90	10	90.37	89.47	90.80	90.21	+0.21

ABBREVIATIONS:

R.T.O.—Refinery Oil Treated with the Phenolphthalein, Oil Brown M and Methyl Red. A.O.—Oil Used for Adulteration. O.B.M.—Oil Brown M. M.R.—Methyl Red. F—Phenolphthalein.

Treatment of a 2000-gal. batch of oil: Place in a suitable blender 2000 gal. of oil to be treated. Heat to 120 deg. fahr. under constant agitation and then add the identifiers in the following order: Methyl Red-Pyridin, Oil Brown M, and finally the Phenolphthalein-Hexalin, in the same volumes as mentioned under the individual identifiers respectively.

Test for adulteration: The volumes of samples taken are the same as given in the previous tests. The volume of ether also is the same, as are the amounts of the extraction solutions to be used. The sequence of extraction is as follows: first extract for the methyl red; this is followed by the extraction of the phenolphthalein; finally the Oil Brown M is taken out of the oil-ether solution. The extractions are treated as recommended under the individual identifiers and prepared for the colorimetric determinations. Thus, three individual checks are obtained in *one* sample.

It is of interest to note the very small amounts of ingredients added per gal. of oil treated:

Phenolphthalein -	0.01545 gm.
Hexalin - - -	0.09700 gm.
Methyl Red - -	0.00560 gm.
Pyridin - - -	0.05544 gm.
Oil Brown M - -	0.08000 gm.
Total per gal. of oil treated - -	0.25349 gm.

This would figure out as approximately 0.0007 gm. of ingredients per cc. of oil treated. This small volume actually amounts to a trace and no oil containing it could be called contaminated with foreign substances, even oils as highly regarded as those distributed under the label of the Pennsylvania Grade Crude Oil Association. A quantitative determination of the ingredients used is, practically speaking, impossible as anyone will realize who is familiar with organic analysis. The cost per gal. of oil treated is well within the allowable limit, being $0.0006984.

All in all, then, this "Triple Identifier" is as fool-proof an identifier as one can expect and is the one the writer would recommend to those desiring such an identifier. For results see Table 9.

Nickel Oleate and Compound Identifiers. Nickel oleate and its limitations already have been discussed and little more need be said in connection with the nickel oleate in conjunction with the compound identifiers.

The writer doubts whether any material gain would be had by adding nickel oleate to such combinations as the Oil Brown M-Phenolphthalein identifier or the Methyl Red-Phenolphthalein identifier. There is only one instance where the nickel as such will give a quantitative result: namely, in a refinery-prepared identifiable oil. In this instance the nickel oleate could serve only as an added protection medium against the discovery of the complete identifier used. It is questionable whether the expense involved would warrant this addition. It would appear that these compound identifiers are secure enough in themselves.

What would be gained by using nickel oleate as a crankcase identifier? It would yield no quantitative results, as the nickel content without a doubt would accumulate in the crankcase every time newly-treated oil were added. If another oil were added to a car, an oil not treated with nickel oleate, after having used such treated oil prior to the addition, the results obtained would be misleading. The best one could say upon receiving a nickel test from a crankcase would be: at some time or other oil treated with nickel oleate was used in this particular car. This in itself would not warrant the use of nickel oleate as a crankcase identifier, not even qualitatively.

There is another drawback to the use of any metallic compounds as identifiers. They are subject to comparative ease of discovery upon analysis of the oils containing them.

Finally, if one were to use the nickel oleate one would have to add $0.00035 to the treatment cost per gal. of oil. If nickel oleate alone were used, this cost would fall within the allowable cost limits. In conjunction with other compounds used the treatment cost per gal. might fall beyond the half-cent limit.

Other Substances Capable of Serving as Identifiers. In the course of the study of identifiers for lubricating oils it was found that the following substances could be used for this purpose:

Indicators.
Dye intermediates.
Dyes.

In all instances it is best if the product used is colorless and has a high sensitivity, in order that only small amounts be required.

Such substances should, if possible, be soluble in the medium in which they are to serve as identifier. In event they are not directly soluble, some solvent must be found that will serve as transferring agent. The transferring solvents themselves must be soluble in the medium wherein they are to serve their purpose and at the same time must keep the active identifying agent in complete solution therein. Without a doubt the finding of the correct carrying agent is the most difficult phase in the development of identifiers.

While there are many indicators, dye intermediates, and dyes, thus far

(Continued on Page 82)

MATERIAL CHART

Chart Showing Materials Used per Gallon and per Cubic Centimeter

Identifiers	Components per gal. in gm.					Total gm. per gal.	Total gm. per cc.
	O.B.M.	F	H	M.R.	P		
O.B.M.	0.08					0.08	0.0000211
H-F		.01545	.097			0.09545	0.0000252
O.B.M. H-F	0.08	.01545	.097			0.19245	0.0000508
H-F M.R.-P		.01545	.097	.0056	.05544	0.17349	0.0000458
Triple	0.08	.01545	.097	.0056	.05544	0.25349	0.0000670

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COST CHART

Cost of Treating One Gal. of Oil with the Various Identifiers (As per February 3, 1932)

Substances	Cost of Treating One Gallon of Oil With Identifiers					
	O.B.M.	H-F	M.R.-P.	H-F O.B.M.	M.R.-P. H-F	Triple
O.B.M.	$0.000362			$0.000362		$0.000362
F		$0.000031		0.000031	$0.000031	0.000031
H		0.000085		0.000085	0.000085	0.000085
M.R.			$0.000105		0.000105	0.000105
P			0.000116		0.000116	0.000116
Total Cost	$0.000362	$0.000116	$0.000221	$0.000478	$0.000337	$0.000699

ABBREVIATIONS:

O.B.M.—Oil Brown M. F—Phenolphthalein. H—Hexalin. M.R.—Methyl Red. P.—Pyridin. H-F—Phenolphthalein-Hexalin. M.R.-P.—Methyl Red-Pyridin. H-F O.B.M.—Hexalin-Phenolphthalein-Oil Brown M Identifier. M.R.-P. H-F—Methyl Red Pyridin-Hexalin-Phenolphthalein Identifier.

(Continued from Page 78)

only a few have been found that work satisfactorily so far as lubricating oil specifications are concerned. Specifications, whether they are government specifications or trade specifications, matter little, identifiers will have to conform with them. This simply means the introduction of identifiers into an oil must not change the oil in any manner, shape, or form and thus cause it to misconform with such specifications.

In the lubricating industry it is necessary to have identifiers stable toward heat and sunlight. They must not separate from the oil. They must be uniformly dissolved in the oil and form a homogeneous whole. They must not change any of the properties of the oil, which might be detrimental to such oil, especially those wherein the specifications are within narrow limits. The identifier in some instances must be present in such small amounts that they may not be interpreted as adulterants themselves.

If the time ever comes that cans, as used today, will be abolished, the writer has several combination identifiers available and can work out others. Meanwhile, the examples set forth in this article may instigate thoughts along other lines that may turn out useful to other industries.

Summing up the essentials contained in this series of articles:

1. It is possible to determine within an accuracy of 0.2 percent the amount of adulteration of lubricating oils. The adulteration may be with oils of the same base, with oils of other bases, and vegetable or animal oils.

2. The adulteration is measured colorimetrically by the use of correct filters. This gives visual tests; vital legally.

3. The color for the determination of the adulteration of lubricating oils is produced by the addition of very small amounts of either indicators, dye intermediates, or dyes to oils produced at a refinery or in the field, either directly or by means of a carrier or carriers.

4. The substances used for the identification for the degree of adulterations of lubricating oils have been termed "Identifiers."

5. The essentials of such "Identifiers" are: complete solubility in the oil; high sensivity for color reaction in order to use such identifiers in very minute quantities; stability toward heat and sunlight; they must be hard of detection by outsiders. Their addition to an oil must not increase the cost of production more than one-half cent per gal. of oil treated; they must not alter the properties of an oil to such an extent that the oil would not meet all specifications, government or otherwise; and above all they must be decisive as a claim for adulteration before a court and jury.

6. As brought forth in this paper, none of the individual identifiers would answer, *per se*, all the demands made upon such identifiers, given under 5. Though the writer does not assert it impossible to find only a single identifier useful for the purpose, he feels it is highly improbable that such a single substance will ever be found, unless such a substance has a variable color range, the colors being brought forth by different extracting agents, or a very difficult single extracting agent. Such substances have been tried with success. Some were soluble either directly or by means of carriers in the oil.

7. The principle of camouflage developed in this work proved the most satisfactory. This makes use of two or more suitable individual identifiers, one covering the presence of the other. Such combinations as mentioned in the article proved most satisfactory and conformed in every detail with the demands made upon such identifiers.

In concluding, the author wishes to express his sincerest thanks and appreciation to those members of the Western branch of the firm for whom the work was done. The highest appreciation goes to my capable assistant, Edward Marinoff, who, throughout all trials and tribulations, worked faithfully with the writer on this very interesting problem.

(EDITOR'S NOTE: This concludes the series of articles by Mr. Fischer on this subject.)

Solving a Valve Problem

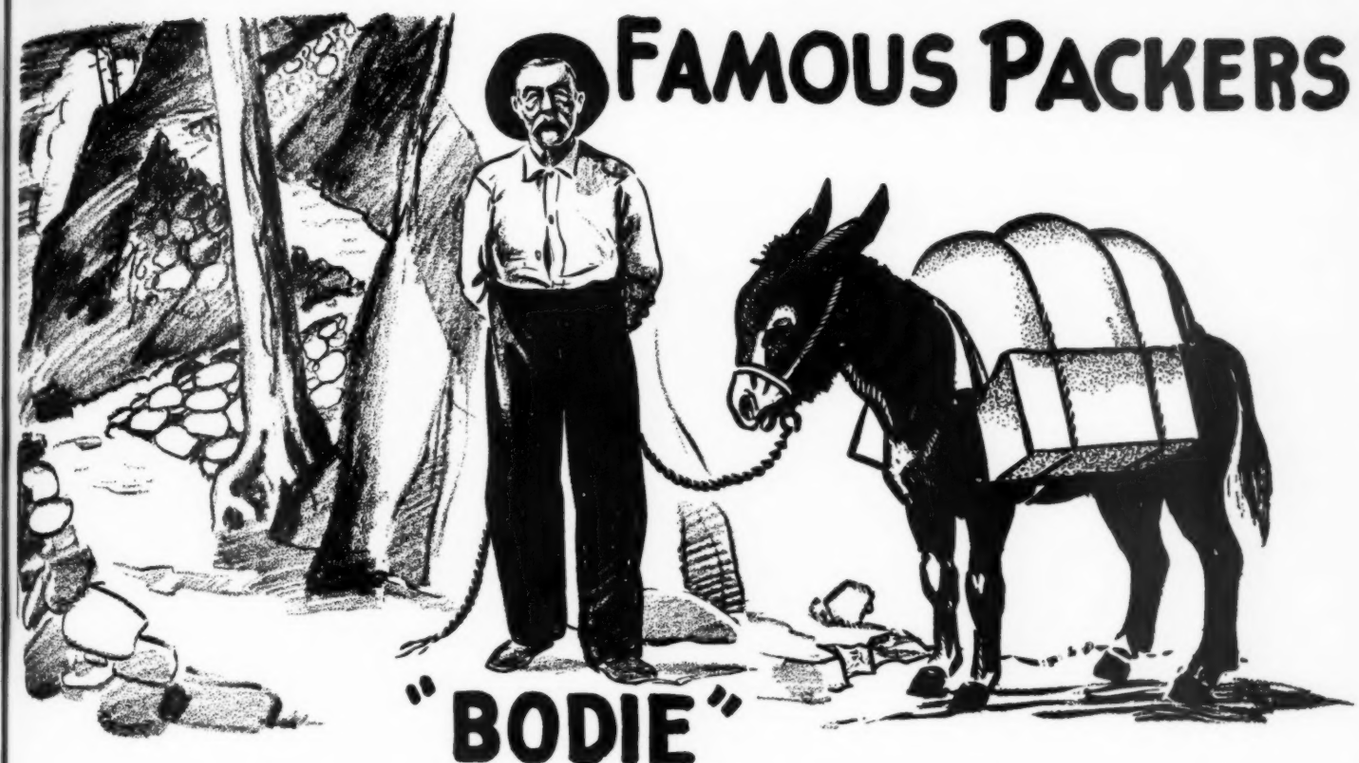
INTERNAL combustion engines burning natural gas require a critical selection of materials in their vital parts. In choosing the material for the seating surfaces of natural gas engine exhaust valves, such a selection is particularly important. The corrosive action and heat of the burning gases are extremely hard on ordinary materials. In addition, wear, resulting in the valves' pounding in, also puts a limitation on the choice of materials, especially since the temperatures in a combustion chamber are so high that most metals begin to soften under such service.

In eight 250-hp. natural gas engines at one of the large gasoline plants in Oklahoma, these factors limited the life of cast-iron valve seats and special seat inserts to from six weeks to three months. This costly maintenance problem has now been solved. Exhaust valve seats of low carbon steel hard-faced with an extremely wear-resistant alloy of cobalt, chromium and tungsten now last from 12 to 16 months under the same service.

Solid cast bushings of this same hard alloy, Haynes Stellite, also are used as valve guides in the same engine. Although these valve guides have been in service for more than two years, they show no signs of wear whatsoever.

The non-ferrous alloy used in both of these applications has been found to fit these requirements. Inherently hard, it retains its hardness throughout the red heat range. It is a most abrasion-resistant material, takes a high polish that does not gall or seize, is applied in the usual manner to the exhaust valve seats by the oxy-acetylene welding process, and the welded deposits are easily ground by means of recently-developed precision grinding equipment.

FAMOUS PACKERS



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Type "GT" Control Head Hook Wall Type Tubing Packer with Multiple Short Rubber Packing Medium and Long Valve Lift

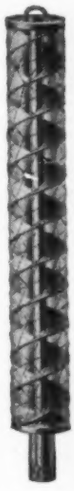
Type "GL" Control Head Tubing Liner Packer with Multiple Packing Medium

Type "F" Hook Wall Packer with or without Bleeder Valve and with One Rubber Packing Medium

Spiral Tubing Packer to Pack off Bottom Hole Water in formation or in Casing

Spiral Casing Packer to Pack off in Bottom Hole Water in formation or in Casing

Spiral Bottom Hole Plug to Plug back or shut off Bottom Hole Water in formation or in Casing



The complete GUIBERSON line of patented Control Head and Spiral Packers, and Bottom Hole Plugs has reduced to an exact and perfected science the process of packing oil wells. Every oil well packing requirement is met by a particular type of GUIBERSON Packer. The above packers are unique in offering the five essentials in packing an oil well: (1) All GUIBERSON Packers pack tight: (2) All GUIBERSON Packers will hold indefinitely: (3) All GUIBERSON Packers pack at any required depth: (4) GUIBERSON Control Head Packers will run in against high gas and heavy fluid pressure: (5) GUIBERSON Control Head Packers enable operator to have complete control at all times— he can set, reset higher or lower, open or close passage and remove packer at any time without damage to well or to packer.

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GUIBERSON

BETTER BE SAFE THAN SORRY

Western Petroleum Refiners Association at Hot Springs, Arkansas

• Bright Outlook Seen

By C. M. BOGGS, President,
Western Petroleum Refiners Association

WHEN Mid-Continent refiners gather in Hot Springs, Arkansas, April 26 to 28 for the 25th annual meeting of the Western Petroleum Refiners Association, they can look back upon the 12 months that have elapsed since their last meeting with a feeling of some satisfaction.

The outlook for the next 12 months likewise is encouraging with healthy progress indicated in the fields of economics and technical development.

Of major importance in the last 12 months have been lessons in applied economics that most refiners have absorbed. Lesson number one has probably been the simple application of the law of supply and demand by which refiners have had it impressed upon them that production cannot materially exceed demand without an unfavorable effect upon market price.

That refiners have recognized the application of this principle is indicated in the close balance between production and shipments maintained throughout 1936. The Mid-Continent refiners, who as a group provide almost 25 percent of the gasoline consumed by the nation's motorists, gauged their operations so closely that production exceeded shipments by less than one percent.

As a group the Mid-Continent refiners held in storage a 30-day supply of gasoline at the end of 1936, the same amount, in terms of days-supply, that was on hand at the end of 1935.

Technical progress in the refining art in 1936 was, while not so spectacular, nevertheless substantial. The increase in the output of cracked gasoline probably was the outstanding feature. In 1936, for

C. M. BOGGS

Will Hold Twenty-Fifth Annual Meeting April 26, 27, and 28, 1937

For Refining Industry ●

the first time in history, cracked gasoline output exceeded straight run gasoline output. The refiner therefore added further to the conservation of crude resources by means of the greater yields afforded by the cracking process.

That the Mid-Continent refiner holds a place well to the fore in technical development is indicated in the statistics showing gasoline yield for each barrel of crude processed. The yield in the Mid-Continent area was 55.6 percent, compared with an average yield in the United States of 47.3 percent. Only in the Rocky Mountain and Indiana-Illinois districts were higher yields obtained. (Items 182 to 193, W.P.R.A. statistics).

Other evidence of technical progress in the refining art will be revealed in the technical section of the program at the W.P.R.A. meeting. Subjects for discussion in that section include all phases of refining from the time the crude oil enters the plant until the finished gasoline enters the motorists tanks. Although these discussions will be carried on largely by technicians and plant operators, it is interesting to note that the aim of all discussions is the improvement of gasoline and other products that American motorists consume.

Looking forward to 1937, forecasts are for an increase of approximately ten percent in gasoline consumption, an equal or greater increase in lubricants, and a substantial increase in consumption of fuel oil, burner oils, and Diesel fuels because of the steady increase in industrial activity.

A recent trend is for the burning oils and distillates to assume their places as major products rather than being looked upon more or less as by-products. A similar trend also is noted in the production and consumption of petroleum asphalts and road oils.

A few years ago asphalt and road oil were considered merely temporary road surfaces to be used until a permanent surface could be applied. Today, because of advances in manufacturing processes and greater knowledge of the possibilities of asphaltic road construction, the product is being accepted for use on all classes of highways, and asphalt is assuming its place as a major petroleum product. Equipment specially designed for the production of asphaltic materials has been developed and is being improved. Asphaltic materials today are sold on specifications as rigid as those for gasoline and lubricating oils.

Another trend of interest to the refiner is in the greater use of oils in rural homes where electricity is not easily available. American inventiveness has developed means of producing ice for domestic use from heat produced by oil-burning equipment. Rural homes, where in other years the farmer had to pump his water for drinking and cooking, are now equipped with oil-burning pumping systems. Farmers' homes frequently are lighted as well as those in the city by means of domestic electrical systems operated by oil.

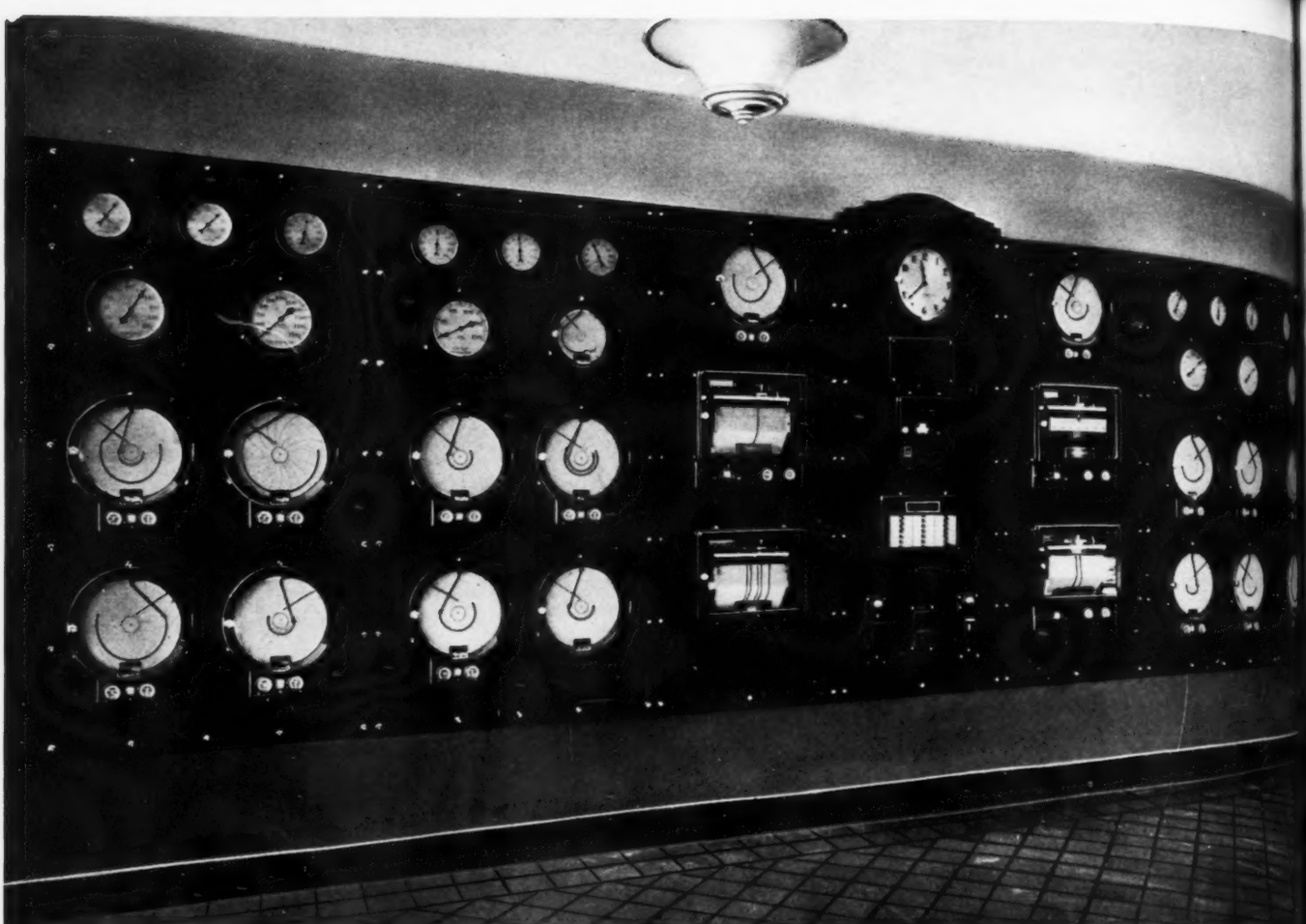
Even in the field of taxation encouraging sunlight begins to appear through the clouds. Although several state legislatures, recently in session, made serious attempts to burden the petroleum industry with greater taxes, they were not uniformly successful. Several legislatures met and adjourned without enacting any legislation detrimental to the industry. Several others took steps to prevent further diversion of gasoline taxes to other purposes than road building for which they were originally assessed.

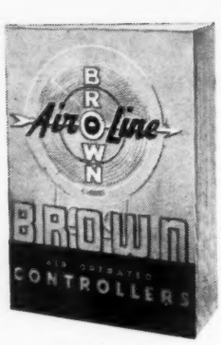
Generally, it appears that the future of the refining branch of the petroleum industry rests squarely on the shoulders of each individual refiner. His success in marketing his product readily and at a reasonable profit depends upon his own understanding of the simple economics of his industry and his application of them to his daily operations.

Those Mid-Continent refiners who will meet in the technical sessions and in the general sessions of the annual meeting of the W.P.R.A., first of all, will celebrate the 25th anniversary of the association's organization. They also will celebrate in more serious mien a quarter-century of progress in the refining art and they can congratulate themselves that their lessons in applied economics have been learned at not too great an expense or sacrifice.

Southport Refinery "On Stream"

UNDER COMPLETE CONTROL





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The Brown Air-o-Line Centralized Control Board installed at the Southport Petroleum Co. for the control of the new Donnelly Cracking Unit — engineered by Mid-Continent Engineering Corporation, Consulting Engineers, Dallas, Texas — assures accurate measurement and positive control in the coordination of temperatures, pressures, flows and liquid levels. The Brown Air-o-Line Controllers mounted on the above board include flow, pressure, liquid level and potentiometer controllers equipped with 1% to 150% Throttling Range and Automatic Reset.

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Brown Air-o-Line Controllers not only confine refinery processes within limits, but "line out" control at the exact desired control point, regardless of rate or thruput changes. Designed for outstanding performance with simpilicity, Brown Air-o-Line Controllers encourage operators to obtain the "best possible"—not "just good enough" control results.

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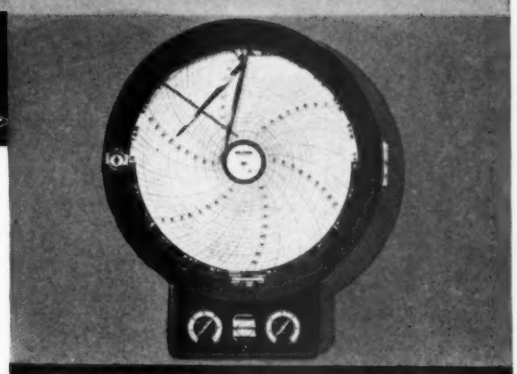

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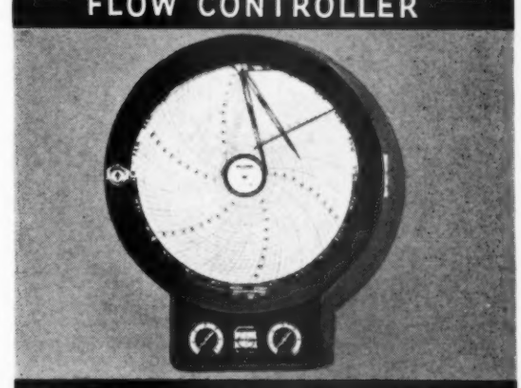

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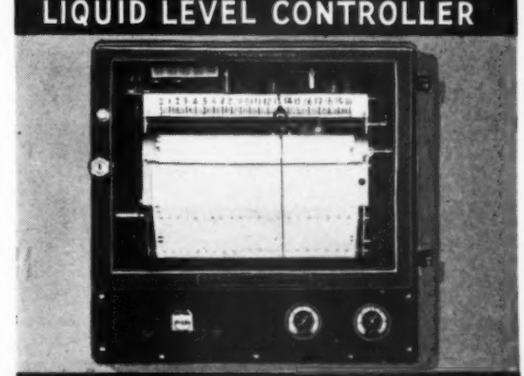

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OPERATED CONTROLLERS

OUTSTANDING PERFORMANCE WITH SIMPLICITY

Quarter-Century of Growth in Mid

By A. V. BOURQUE, Secretary-Treasurer,
Western Petroleum Refiners Association

A QUARTER-CENTURY of growth and development in the Mid-Continent refining industry will be celebrated at the 25th "birthday party" of the Western Petroleum Refiners Association at Hot Springs, Arkansas, April 26, 27, and 28.

The refiners association is one of the oldest trade associations in the petroleum industry and in its 25 years of continuous existence has played an important part in the rise of the Mid-Continent fields to their present position.

The W.P.R.A. was organized in November, 1912, just as the Mid-Continent area was assuming importance. Problems of the refiner in those early days were as varied and as complex as those of today. They were, however, of a somewhat different nature. There were, in 1912, no universally recognized specifications for gasoline or other petroleum products and many grades were marketed, each with its own claim to superiority. There was not the army of educated and discriminating motorists we have today and there was general confusion and lack of understanding as to what was a quality product.

Freight rates were numerous, not uniform and perplexing, resulting in discrimination to many refiners and unjust advantages to others. Questions concerning tank car construction and usage confronted the refiner and before the organization of the W.P.R.A. there was no means for Mid-Continent refiners to speak as an organized group.

With the rapid discovery of new oil fields in what is now the Mid-Continent area, a new crop of refiners developed, many of them operated by men with no previous experience either in the manufacture or production phases of petroleum. Others were mere stock-selling enterprises established with no idea of permanence but to obtain enormous promoters profits.

The Western Petroleum Refiners Association came into existence largely because of the patch-work freight rate structure, which threatened to ruin those refiners farthest from their markets. Unjust claims of superiority and better performance made by refiners in the newer districts was another reason leading to the organization of a permanent association.

At the time of its organization and for many years after, every member of the association was a small non-integrated company. Many of the integrated refiners who are now members have grown from those original members.

In its early years the association devoted itself extensively and intensively to problems connected

A. V. BOURQUE

Mid-Continent Refining Industry

Vital Role Played by the W.P.R.A.

with the freight rate structure. A freight rate bureau was established with offices in Chicago and branches in Kansas City and Fort Worth. The association also used its influence to obtain acceptable standards of tank car construction together with rules for their use.

In 1915 new cracking processes were developed and made commercially available with their greater yields and higher quality products. Technical committees of the association made exhaustive studies of the various processes, providing members with the results. Members thus were enabled to select the type of process that seemed best suited to their individual use. It is interesting to note in this connection that in 1936, for the first time, cracked gasoline was marketed in greater quantities in the United States than straight-run gasoline.

The statistical service of the association was of great value to its members and was continued until the advent of the NRA codes when many of the statistical services were duplicated by federal and other organizations. It was revived following the lapse of the code and is now an important departmental activity.

During the days of the petroleum code, Howard Bennette, then president and managing director of the association, maintained his headquarters in Washington as national coordinator. Many of the normal activities of the association were permitted to lapse because they were duplicated by code authorities. With the passage of the code previous activities were revived and a number of new departmental activities undertaken.

Throughout its existence the W.P.R.A., to a great extent, has been a scientific organization. The association and its members have laid great stress on ethical business practices, the marketing of quality products, improvement of methods of manufacture, safety in operations, the study of manufacturing costs and the inauguration of rigid specifications. The association is recognized by state and federal governments as well as by scientific organizations as the official representative of the Mid-Continent refiner.

The technical sessions of the annual meetings, as indicated by the program for this year, are comprehensive and participated in by leaders in the petroleum industry. Those sessions are recognized as outstanding contributions to the art and science of petroleum refining.

The association has not limited its activities to the field of gasoline but has conducted successful educational campaigns to increase the public acceptance for lubricants manufactured from Mid-Continent crudes. For the past two years it has conducted a campaign for the greater and more efficient use of road oils and asphalts.

One of the most important recent achievements has been the adoption of its specifications for gasoline with respect to octane brackets, vapor pressure, and gum content. The octane brackets first established by the association in 1931 have been revised from time to time and have been adopted by the industry and by the trade press. They have resulted generally in a more uniform product being marketed and have been of great benefit to the motoring public.

The specifications limiting gum content and vapor pressure adopted by the W.P.R.A. and its members in 1936 have given the public a more uniform and a higher quality gasoline than was generally available before the specifications became universal.

Originally the association's members were almost entirely in Oklahoma and Kansas. From time to time smaller organizations in Texas and other Mid-Continent states have merged with W.P.R.A. In 1936 the Louisiana-Arkansas Refiners Association, after eight years of individual existence merged with W.P.R.A. so that today it is the only refiners association in the Mid-Continent.

As the association and its members celebrate the quarter-century milepost at Hot Springs this year they can review with measurable satisfaction the part they have played in bringing Mid-Continent refining development out of the chaos that frequently threatened. They can look at a substantial, well-founded industry, performing a needed service to the public and providing a huge army of motorists with high-quality petroleum products.

Those who attend the "birthday party" will, if their memories go back 25 years, recall with some pride the pioneer efforts of those early day refiners. They can truly marvel at the progress that will be revealed in the technical and economic discussions of refining practices and equipment. They can, I am convinced, look forward confidently to still greater development and to the rendering of still greater service to the consuming public.

Comprehensive Technical Program for W.P.R.A. Meeting

A SERIES of prepared papers and informal discussions that will include all phases of refining from the time the crude oil leaves the well until the finished gasoline enters the motorist's car will form the technical section of the program for the annual meeting of the Western Petroleum Refiners Association at Hot Springs, Arkansas, April 26, 27, and 28.

The technical program, announced by the committee headed by Emby Kaye, of the Skelly Oil Company, is the most comprehensive ever attempted by the refiners association. It is patterned generally after the regional technical programs that proved such a success last fall.

Two general methods of removing salt from crude oil before it is processed will be discussed in prepared papers and enlarged upon by discussion from the floor. The subject of reforming as a method of manufacturing high-octane gasoline without the use of lead will be discussed by two authors, with emphasis on the economics, as well as the technique, of the process.

The treatment of gasoline for the removal of gum formation and the use of various types of inhibitors to prevent gum formation will be presented from the viewpoint of a refiner whose experience includes all the well-known methods.

Three processes of gasoline sweetening will be discussed in papers presented both by manufacturers and refiners with the economic advantages of each forming the theme of all the discussion.

This year's annual meeting of the W.P.R.A. will mark the 25th anniversary of its organization and the technical section of the program will provide an excellent illustration of the progress of the refining art in the last quarter-century.

The technical program in detail:

"Salt Removal From Crude Oil—Electrical Process," by the Petroleum Rectifying Company.

"Salt Removal From Crude Oil—Chemical Process," by the Skelly Oil Company and other refiners.

"Reforming," by Wright W. Gary of the M. W. Kellogg Company. (A second paper on reforming will be presented by an author to be announced.)

"The Economics of Gum Removal and Inhibiting," by Dr. C. R. Wagner, The Pure Oil Company.

"Gasoline Sweetening: Doctor Sweetening," by C. W. Rippie, Solvay Sales Corporation.

"Lead Sulphide Process," by Stratford Engineering Company with D. B. Nutt, Standard Oil Company of California, delivering the paper.

"Copper Chloride Treating," a review by C. W. Rippie and others.

Members of the committee who have arranged the program are Mr. Kaye, chairman; H. G. Osborn, Continental Oil Company; H. W. Camp, Empire Oil and Refining Company; W. F. Sims, Panhandle Refining Company; and R. B. Pierce, Louisiana Oil and Refining Company.

Arrangements for the general program are in the hands of this committee: R. W. McDowell, Mid-Continent Petroleum Corporation, chairman; T. H. Barton, Lion Oil Refining Company; T. A. Helling, El Dorado Refining Company; Roy B. Jones, Panhandle Refining Company.

The general program will be devoted to discussions of economic and manufacturing problems and will include addresses by nationally-known speakers and authors.

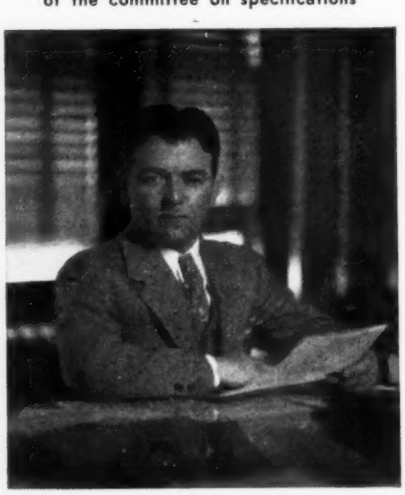
Among the speakers on the general program are: Fayette B. Dow, association counsel of the Washington office, who will discuss federal and state legislation affecting the refiner. Ralph Horween, Chicago attorney, who will deliver a paper devoted to anti-trust legislation with an analysis of trade association activities with respect to the anti-trust laws.

H. Merle Smith, economist and lecturer on salesmanship.

Tom Collins, author and humorist of Kansas City, who will speak at the "birthday party," which will be substituted for the banquet.

The president's annual address, reports of committees, nomination and election of officers, and general discussion of future activities of the association will complete the program.

Emby Kaye, vice-president in charge of manufacturing, Skelly Oil Company, who is chairman of the Manufacturing Committee of the W.P.R.A. and in charge of arrangements for the technical program at the annual meeting. Mr. Kaye also is chairman of the committee on specifications



Tom Collins, Kansas City, author and humorist, who will be the principal speaker at the birthday dinner party at the annual meeting of the Western Petroleum Refiners Association

R. W. McDowell, vice-president in charge of sales, Mid-Continent Petroleum Corporation, who is chairman of the Program Committee for the 25th annual meeting of the W.P.R.A. Mr. McDowell also is chairman of the standing committee on posting of tank car prices

360° TURNS 365 DAYS A YEAR

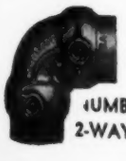
NUMBER 10
3-WAY SWIVEL

NUMBER 20
1-WAY SWIVEL

NUMBER 30
1-WAY
SWIVEL

NUMBER 40
1-WAY SWIVEL

NUMBER 50
2-WAY SWIVEL



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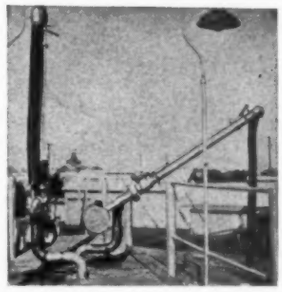

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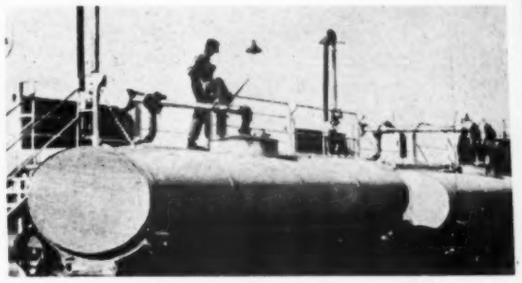

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Above—Filter building and heat exchangers. Chiller building is shown at the extreme left. The control room and pumps are on the ground floor of the filter building.

Right—View of solvent recovery system for benzol-acetone dewaxing.

Modern Oil Refining Processes

Demand for superior grade lubricants has resulted in remarkable growth of refining processes

By GEORGE F. FITZGERALD

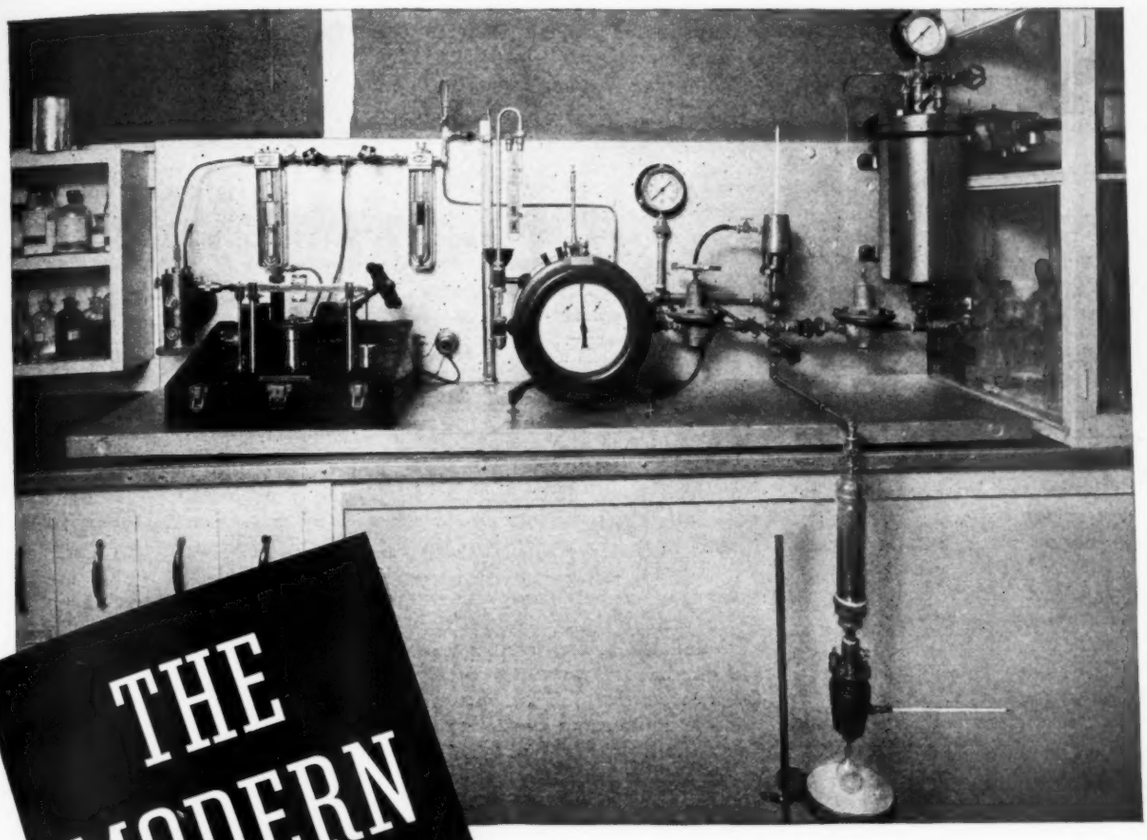
PETROLEUM refining is one of the most important process industries. It employs most of the unit operations of chemical engineering, such as fluid flow, heat transfer, distillation, absorption, filtration, and extraction. Typical chemical processes are acid and alkali treatment, percolation and contacting with fuller's earth, cracking, and hydrogenation. These operations are applied to the fullest extent in the manufacture of lubricating oils because of the importance of this market. Before 1930 very little development of new treating processes had been made. Since then, however, the necessity of producing improved oils has become urgent. A demand for oils of high viscosity index has been built up by advertising and it has become imperative for all refiners who hope to retain their markets to find methods for improving the temperature-viscosity relations of their products. The term viscosity index is applied to this relation and is the numerical measure of the change of viscosity with change in temperature.

Automobile lubrication is a factor of universal importance and consequently the greatest efforts have been expended in the direction of better automotive lubricants. The need for improvement is readily apparent after the briefest survey of recent changes in motor cars. The trends toward higher and higher compression ratios, higher sustained road speeds, and faster acceleration all make unusual demands upon lubricants. They must be able to withstand higher bearing temperatures and pressures without oxidation and corrosion of bearings and cylinders. Oxidation breaks down the oil and forms gum, sludge, and other non-oily materials injurious to motors. Corrosion of motor parts clearly is undesirable because of the resultant pitting and eventual failure. A high viscosity index is important in order that satisfactory lubrication may obtain in the wide range of temperatures between cold-starting and high-speed conditions. Low viscosity index oils may be suitable at either extreme but fail to give the best results over a wide range. The improved oils give the best service because of their ability to resist the thinning effect of increasing temperatures.

The industry virtually has agreed that the paraffinic oils with their inherent high viscosity index are best suited to meet these new requirements. But the source of natural paraffin base oils is limited and some way of producing oils of comparable quality from asphaltic and mixed bases had to be found. This goal has been approached by a number of solvent-refining processes that give the oil better physical and stability characteristics. It has been found that oil from most sources can be fractionated into high and low viscosity index components. This separation cannot be effected by distillation or any of the common operations and does not depend upon change in the chemical character of the oil. Fractionation on the basis of viscosity index is the outstanding contribution of the solvent-refining methods.

Twelve or more commercial processes are used for the production of high-grade lubricants from any of or all the available crudes. These processes employ treating agents entirely foreign to the petroleum industry that have never departed far from the traditional acid and soda treatment. Among the solvents used are methyl-ethyl ketone, benzol, chlorex, propane, cresylic acid, furfural, nitrobenzene, crotonaldehyde, sulphur dioxide, phenol, trichlorethylene, and ethylene dichloride. Their use is based on the principle of selective solubility and their application will be described under three general heads: extraction, de-asphalting, and dewaxing.

In extraction, solvents are chosen that have a high selectivity for the



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Tests made with this equipment in our Los Angeles laboratory show that, if water once displaces oil in an oil sand, the permeability is decreased from 2 to 100 times. This extra resistance set up by the presence of water—due to capillary effects—impairs initial production, rate of flow and probably the ultimate recovery from a well.

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naphthenic components. These are undesirable because of their dark color, low viscosity index, and tendency to oxidize forming gum, sludge, and other damaging by-products. The solvent extracts the naphthenic portions forming the extract solution; the solvent itself is slightly soluble in the oil and thus forms the raffinate solution. Usually only one solvent is employed but in one commercial process two immiscible solvents are used: one (propane) with a high selectivity for paraffinic materials, the other (cresylic acid) for the naphthenics.

The principle of countercurrent flow is very well illustrated in solvent refining. The opposing streams of oil and solvent are carefully contacted to obtain the maximum extraction without undue emulsion formation. Segregation is effected by gravity settling and the raffinate solution proceeds in one direction and the extract solution in the other. Where two solvents are used, as already mentioned, they are introduced countercurrent to each other and the oil is charged at an intermediate point. In this case the solution rich in paraffins is washed by the freshest naphthene-dissolving agent and vice versa. In the Duo-Sol process segregation is promoted by the immiscibility of the solvents.

It is customary to apply the solvents counterflow in several stages, although single-pass countercurrent towers are being developed. In a typical four-stage process the fresh oil charge entering No. 1 treater is mixed with the thrice used solvent from No. 2 treater. After settling, the extract solution is pumped to the solvent recovery system where the solvent is distilled off and returned to the process at No. 4 treater. The raffinate solution passes to No. 2 treater where it meets the extract solution from No. 3 treater. The procedure is continued until in No. 4 treater the raffinate solution is stripped by fresh solvent, which completes the extraction. Since the raffinate and extract must be kept separate they are distilled in different systems but all the solvent is returned to the process. Though based on simple principles, solvent extraction gives rise to numerous practical problems. Too violent mixing forms very stable emulsions, while insufficient mixing results in a product of low viscosity index. Separation usually is never complete but must be kept at maximum. Choice of treating temperatures and solvent ratios are all-important but must be arrived at by actual trial. Low yields, corrosion of equipment, and solvent losses are other difficulties that must be overcome.

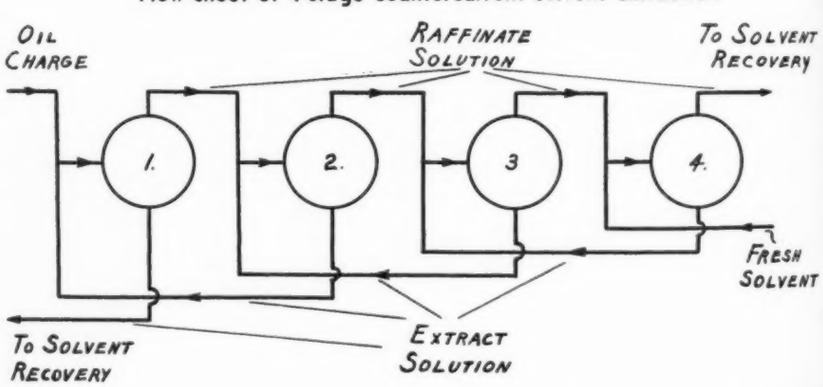
Solvent extraction results in the removal of relatively large fractions of the original oil. The second type of solvent application is not so drastic but nevertheless is very effective in improving certain types of oil. The paraffinic oils can be de-asphalted by this method with consequent decolorizing and removal of asphalts, resins, and carbon-forming bodies. The resistance to oxidation is improved but viscosity index characteristics remain substantially unchanged. The principle governing de-asphalting also is selective solubility but the effect of temperature is potent. A solvent, or rather an anti-solvent, is used to precipitate the asphalt. In this case the oil is dissolved in the solvent and by proper choice of temperatures the content of asphalts, resins, and heavy ends and wax may be precipitated with very little loss of oil. At ordinary temperatures oil and solvent (propane) are completely miscible but as the temperature is raised non-paraffinic fractions are thrown out. At 120 deg. fahr. all asphaltic matter is precipitated and at higher temperatures color bodies and carbon-forming constituents drop out. On the other hand, as the temperature is dropped below normal wax is crystallized and may be removed by filtration. The versatility of propane permits its use for both de-asphalting and dewaxing. In addition, the dewaxing operation is aided by employing self-refrigeration, that is, part of the liquid propane is evaporated to chill the remaining solution. The final steps in propane dewaxing will be mentioned later in connection with other methods.

Four of five commercial solvent-dewaxing processes are in use, differing greatly in detail. Basically, however, they require dissolving the wax-bearing oil in a solvent that has a low solubility for wax and petrolatum at lowered temperatures and then separating the wax from the chilled solution. In these operations thorough application of the principles of heat transfer is essential in order that refrigeration costs may be low. The charge solution is chilled in double pipe exchangers through which the cold dewaxed solution passes on its way from the filters. If further refrigeration is required it is supplied by circulating brine or by direct expansion of ammonia. The cold solution is then pumped to rotary filters where the wax content is removed and washed free of oil. One, two, or three solvents may be used depending upon the nature of the oil and the pour tests required. As these solvents are expensive and also inflammable every effort is made to prevent losses. Closed systems are employed and usually an atmosphere of flue gas or other inert gas is maintained in the vapor portion of the system to prevent fires or explosions.

Solvent-treating processes when applied to asphaltic and mixed-base stocks yield oils of improved quality approaching the paraffinic. As quality is improved the yield naturally is reduced so a balance must be struck between maximum quality and maximum yield. These oils in service show less breakdown due to oxidation and sludge formation, better color, and lower carbon residue, as well as higher viscosity index. Paraffin base oils when so treated are correspondingly enhanced in value, thus tending to maintain the original quality differential.

The increase in lubricating quality is difficult to define except in terms of actual service tests. Despite the numerous laboratory tests applied to lubricating oil there is no test or even group of tests acceptable as a criterion. The usual physical tests and accelerated oxidation tests give useful information but cannot be translated directly into terms of service characteristics. A problem for the future is the standardization of a test for lubricity that will accurately rate oils as they would be rated by lengthy service tests. The Federal government, airplane manu-

Flow sheet of 4-stage countercurrent solvent extraction



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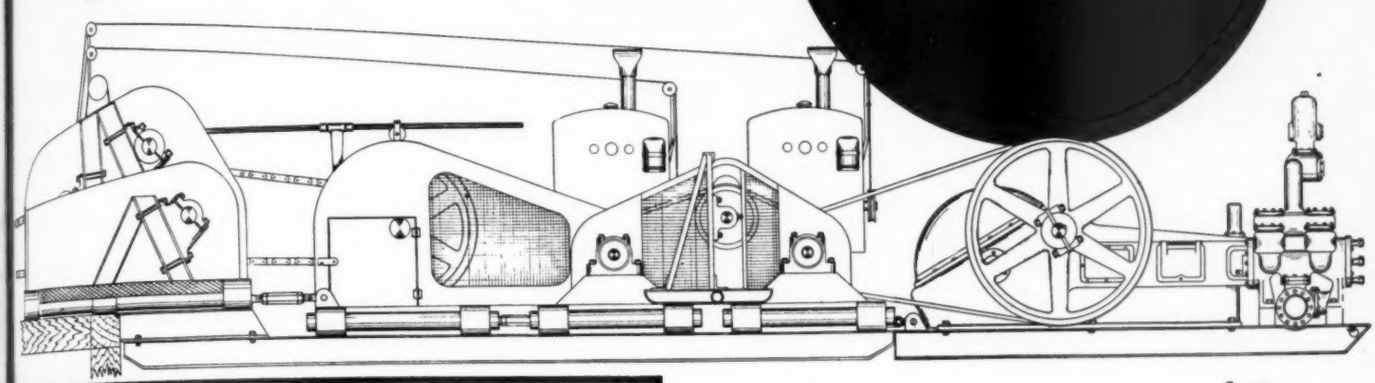

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Bridgeport Mechanical Rotary Drilling Rigs are compact and exceptionally sturdy, smooth running and economical to buy and use. They are designed to reduce drilling costs and to add to operating profits. Users are demonstrating that they do exactly that. We invite you to see them in operation and talk to the users.

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facturers, and commercial airlines require service tests before final acceptance of motor oils.

Another problem connected with solvent refining is that of utilizing the extracts. The wax and petrolatum, of course, can be processed in the usual way. Dewaxing does not give rise to new problems, as the end products are substantially the same as with the older methods. De-asphalting, de-resining, and solvent extraction, particularly the latter, produce important quantities of extracts that cannot be sold directly as lubricants. These products must be turned to account, however, in order to reduce treating costs. Obviously these extracts have a book value equal to the original oil and some outlet more attractive than fuel oil is required. It is conceivable that naphthenic materials may be converted into lubricants of paraffinic character and when such a process becomes practical there will be profound changes in the oil industry.

To sum up: the requirements of modern automobiles have forced the development of superior lubricants. High-speed cars can no more operate on the motor oils of 1930 than they can on the motor fuel of that period. The manufacturers of mixed-base and asphaltic oils have sought a means of raising the quality of their products to the paraffinic as standard. Not to be outdone, the refiners of paraffinic base oils have developed processes for improving their own high standards. The outcome has been a remarkable growth of refining processes employing a long list of new treating agents. These processes have been adapted to practically every type of oil and treating requirement and they are still in the experimental stage. Indications are that further advancement may be expected for several years.

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Chart for Determining Safe Wooden Beams for Refineries

» By W. F. SCHAPHORST «

HERE is a chart that will be found useful by refinery mechanics for selecting quickly safe beams made of the ordinary woods such as shortleaf pine, white oak, longleaf pine, Douglas fir, western hemlock, white pine, and spruce. The chart is based on data adopted by the American Railway Engineering Association for safe uniformly-loaded wooden beams of rectangular section.

To use the chart simply zigzag a straightedge across three times, or stretch a thread across three times, as indicated by the zigzag dotted line, and the problem is solved.

For example, it is desired to hold 200 lb. per ft. on a 2-in. by 6-in. wooden beam of western hemlock over a span of five feet. Will the beam be safe?

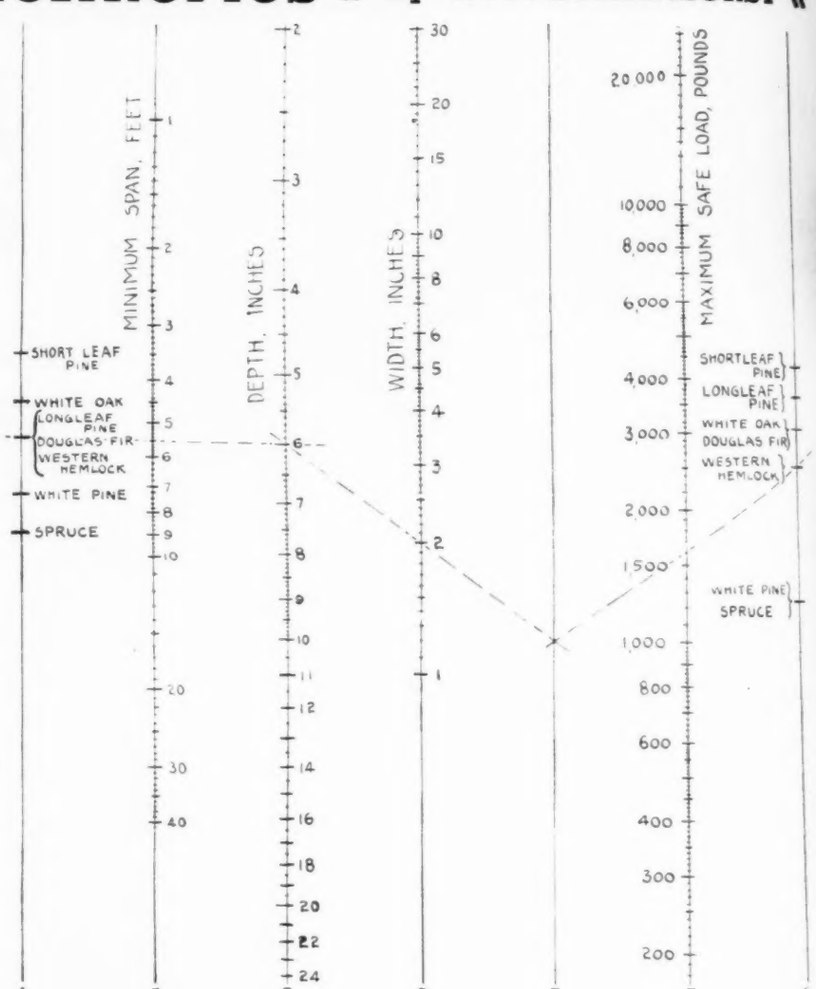
Run a straight line from the point in column A opposite "western hemlock" over to the depth 6-in. column C. The intersection with column B shows the minimum span to be 5.5 feet. The beam therefore will be safe as regards span.

Then from the depth 6-in. column C run a straight line through the width 2 in column D and determine the intersection in column E. Then from that point of intersection run a straight line over to the point in column A opposite "western hemlock." The answer is found at the intersection with column F and is 1600 pounds.

As it is desired to hold only five times 200, or 1000 lb., on the beam, and as the beam will actually hold 1600 lb., it certainly is amply safe. In fact, the chart shows that a beam made of white pine or spruce would be safe under the load.

Inversely the chart may be used for finding any unknown factor or factors. If the kind of wood and the span are known the first straight line through columns A, B, and C gives the minimum depth of beams that must be used. If the width of beam is unknown the line through the columns E, F, G is found next, and lastly the line through columns C, D, E gives the minimum width of beam in column D.

The weight of the beam itself is included in the safe load given in column F.



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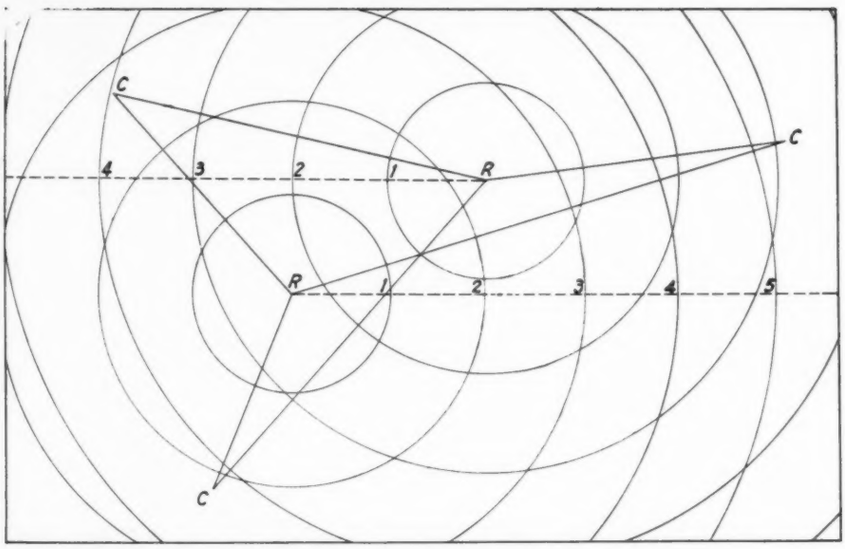

Fig. 1. Illustrating two possible sites, and attendant zone markets, in relation to three sources of crude

C—Source of crude
R—Refinery site

A mathematical determination of the most profitable site in relation to source of crude, size of plant, and potential market

Building That Refinery

By CHARLES W. DEAN*

1. Obtain large-scale, detailed maps, covering the marketing area under consideration.

2. From any point within this area, describe concentric zones of constant radial increase, to cover the entire field of potential activities. (See Fig. 1.)

3. Select any source of possible crude supply in or near this market area, and show the freight per bbl. to the areal center in the space provided in the upper left-hand corner of the "Freight Determination" form, Fig. 2.

4. List all towns within zone 1 of Fig. 1, in column 1, Fig. 2. In column 2, list the total annual gal. consumption cited in the state tax records. Calculate the percentage of each town's consumption to the total of column 2 and extend in column 3. Multiply column 3 percentages against the "Freight In" rate per bbl. and extend in column 4.

5. Insert "Out" freight rates in column 5, multiply by the percentages in column 3, and extend in column 6.

6. Add columns 4 and 6 and extend in column 7.

7. Post group (3) "Freight In" rates in column 8, multiply by the percentages in column 3 and extend in column 9.

8. Subtract column 7 extensions from column 9 extensions and post the differences in column 10.

9. Total column 10.

10. Follow same procedure for zones 1 and 2, combined.

11. Follow same procedure for as many additional zones as a market survey of potential sales may indicate necessary to absorb the output of the maximum sized refinery contemplated.

12. Repeat the entire procedure for every other potential source of crude in or near this area.

13. Repeat the entire procedure, by zones, by sources of crude, *for every other potential site* within this market area.

14. Summarize column 10 totals, by zones, by sites, by sources of crude.

15. The tables so arrived at will correlate all "In" and "Out" freight differentials, as well as shifting market centers, in relation to area and consumption, and will determine the most profitable site, source of crude, and size of plant.

16. On the basis of a 1000-bbl. capacity, a saving of only ten cents a bbl. will amount to more than $30,000 per year. Larger or smaller units may be figured proportionately.

*Denver, Colorado

(Kind of) CRUDE (Town) REFINERY ZONE NO. ____

FRT. IN ____ per Bbl. FREIGHT DETERMINATION

LINE	1 TOWN	STATE	2 1936 CONSUMP (GALLONS)	3 % TO TOTAL	4 PRO RATA FRT. IN	5 FRT. OUT	6 PRO RATA FRT. OUT	7 TOTAL FREIGHT	8 GRP 3 FRT. IN	9 GRP 3 PRO RATA	10 NET FRT. P.B.L.
1											
2											
3											
4											
5											
6											
7											
33											
34											
35											
36											
37											
38											
39											
40											
	TOTAL										

Fig. 2. A "Freight Determination" form

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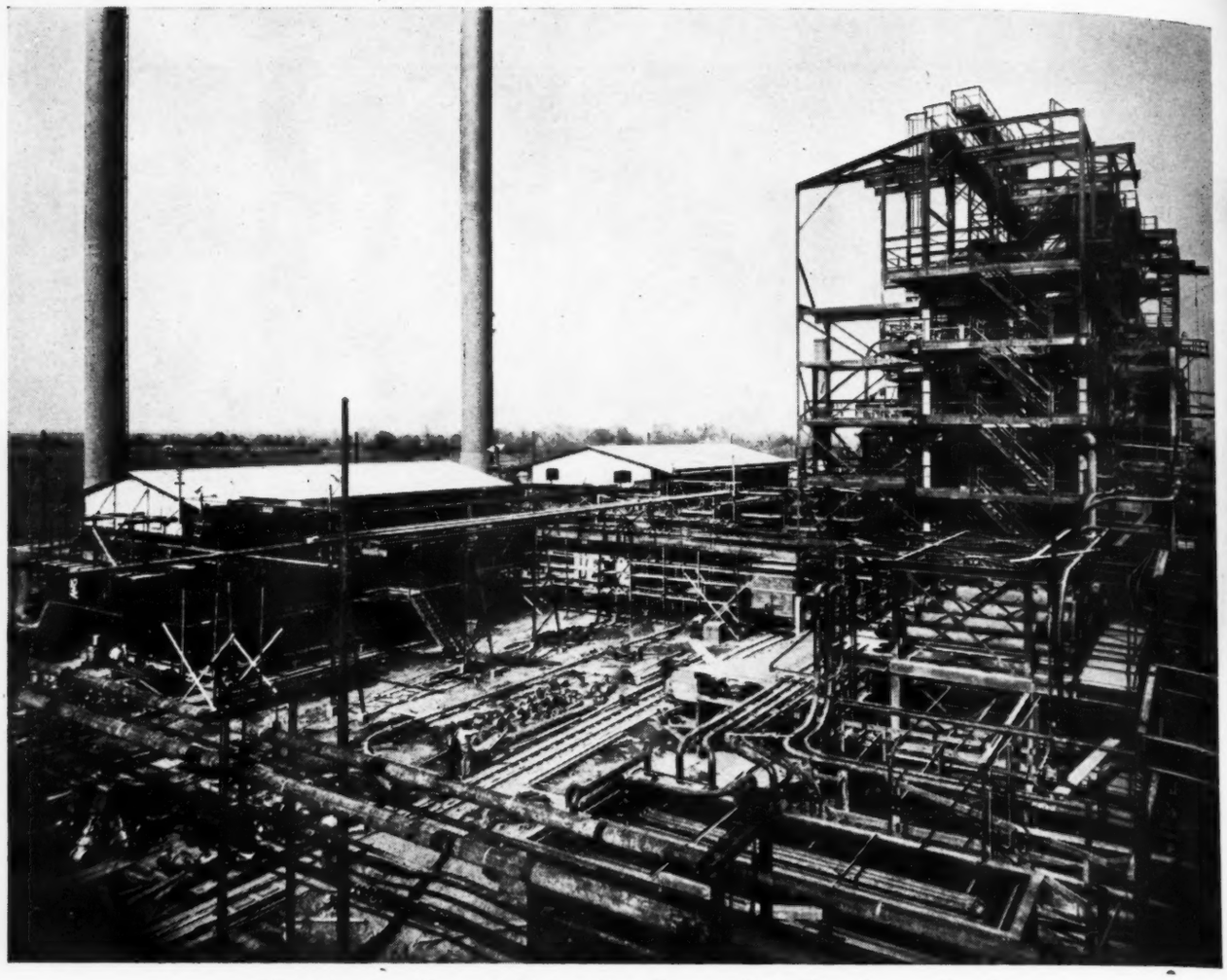

Atlantic's new refinery at Port Arthur, Texas, while still under construction

Atlantic Refinery Completed at Port Arthur

TYPIFYING the expansion of the oil refining industry in Texas, as well as a new technological era, is the new $5,000,000 cracking and polymerization plant at Atreco, near Port Arthur, of the Atlantic Refining Company of Philadelphia. The refinery has a daily capacity of 18,000 bbl. of crude petroleum and is among the first in the country to include a polymerization unit for the production of gasoline from gases generated during the refining process. Construction was started the middle of 1936.

Situated on the Neches River, at the pipe line terminal of the Atlantic Pipe Line Company, the refinery draws its crude petroleum requirements by pipe line from the East Texas fields. The 2,000,000 gal. of fresh water required daily for the operation of the refinery is brought nine miles from its source by means of a canal specially built for this purpose by Texas Public Service.

Products of the refinery include gasoline, industrial fuel oil and domestic furnace oil. Tankers loading directly from the refinery will carry the products to seaboard distribution points in New York, New England, the South, and overseas. Approximately 50 percent of the production of the refinery may be exported to foreign countries.

The accompanying photograph shows two furnaces on the left and the main tower of the cracking unit on the right, at the new Atlantic plant. Its construction at Port Arthur will increase the capacity of refineries there to more than 250,000 bbl. daily.

Michael J. Welsh, formerly manager of The Atlantic Refining Company's refinery at Brunswick, Georgia, has been appointed manager of the new refinery. Welsh entered the employ of The Atlantic Refining Company in 1892. His first position was at the company's Franklin, Pennsylvania, refinery. He was serving as assistant manager of the Franklin refinery when the company transferred him to Georgia in 1919, to become manager of the refinery at Brunswick.

MICHAEL J. WELSH
Manager of The Atlantic Refining Company's new refinery at Atreco, Texas.

Other appointments to executive positions at the Atreco refinery, announced by the company, are Robert Stewart to be superintendent of the refinery, and Harold E. Ramsey to be works engineer. Stewart formerly was superintendent of the refinery at Brunswick, while Ramsey formerly was general foreman of the gas and acid department of the company's Philadelphia refinery. Stewart joined The Atlantic Refining Company in 1909. Prior to moving to Georgia in 1919, he served as assistant foreman at the Philadelphia refinery. Ramsey entered the employ of the company in 1919. Before his appointment as general foreman of the gas and acid department of the Philadelphia refinery he served in the same refinery as superintendent of the power department and later as supervising engineer of research.

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PURCHASED ELECTRIC POWER

- ★ Low Installation Cost
- ★ Greater Efficiency
- ★ Easily hauled from one location to another
- ★ Greater salvage value

LOW OPERATING COSTS

OTHER METHODS

- ★ Higher Installation Costs
- ★ Average Efficiency
- ★ Equipment difficult to transfer from one location to another
- ★ Low salvage value

HIGH OPERATING COSTS

PROFIT BY USING ELECTRIC POWER

PETROLEUM ELECTRIC POWER CLUB

Equalizing Costs and Profits[1]

Rising Costs

BUSINESS in the oil country has been quite satisfactory the past year. Increased number of wells were drilled, new territories discovered, and the demand for oil products has been good.

Steel is required in many forms for the different operations, and now demand has grown until today delivery is the problem. Along with increased demand, prices of raw steel have advanced and, in addition, wages and operating costs of manufacturers have increased.

The buyer in the oil country keeps himself informed and is willing to pay more for his requirements when manufacturing costs rise. The contractor is vitally affected and generally is the last man able to adjust his prices to cover increased costs.

The supply companies play an important part in the industry. They represent the manufacturers and assume the responsibility of carrying the needed requirements for the operators. Generally, selling prices are made by the manufacturers and, also they dictate the margin of profit the supplier receives to cover his investment and services. The business is highly competitive, thereby buyers are assured fair treatment and can rely on receiving quality material and lowest possible prices. There is no better way for the buyer to get his requirements—if every manufacturer found his own markets, selling costs would be much higher. Supply dealers do not need large margins to operate on, as volume and large individual transactions are the answer to the present low selling costs. Gross profits from the sale of oil field supplies are generally 10 percent to 15 percent lower than margins of most other merchants.

On account of rising operating costs, and manufacturers only allowing supply dealers the same margins paid them ten years ago, the average supply company is at present required to furnish material and services on an unequitable basis. Most buyers appreciate the necessity of the supply store—oil men always have shown by their actions that they believe the laborer worthy of his hire—the user expects, and is willing to pay, a fair price for his requirements. If the manufacturer's present profits do not permit him to allow dealers more margin, buyers would be willing to pay the small extra amount necessary, as well as they are willing to pay higher prices to cover the raise in raw material and extra wages paid by the manufacturer.

An inevitable increase in operating costs confronts the oil industry. The observations made herein pertinent to this subject are food for thought.

Equalizing costs and profits in the industry is important. Market prices of crude products must cover costs, but the public is satisfied as it realizes the oil man is entitled to present reasonable prices. The prices of oil products are lower today than most other commodities.

Your Position, and Ours—

In the complicated business of producing oil there are three interests that must have consideration for the economic development of the industry: (1) the manufacturer of exploration and production equipment; (2) the distributor of this equipment; and (3) the operator or user of the equipment. Each performs a definite service for the other and each is entitled to a fair and equitable reward for services rendered. To place any one of the three at a disadvantage, injures the other two and increases cost.

It is obvious that the user of the equipment cannot save for himself the manufacturer's profit by making his own equipment and doing away with the manufacturer. It is also obvious that a manufacturer cannot economically and efficiently manufacture all the many items of equipment used in producing oil. So we find oil field equipment manufacturing divided into separate groups, one making pipe, another rods, another drilling muds, another machinery, and so on, each more or less specializing to increase production, lower costs, and produce better products. Competition forces the saving and advantages on to the user of the product.

But why not eliminate the middle interest—the distributor? Is he on industry's relief roll, taking from both the manufacturer and the user? Analyze his position from both the manufacturer's and the user's standpoint. Suppose the distributor were eliminated entirely, would this mean that the distributor's profit would be gained or saved by either the manufacturer or the user, or divided between them? Common sense and experience says emphatically, "NO."

The elimination of the distributor would bring increased costs for the oil operator. For the user of oil field equipment to obtain the same services he now receives each manufacturer would have to set up a distributing organization, with field stores, warehouses, material yards, sales and service organizations, credit facilities, executive offices, and what not. Each manufacturer would necessarily pass on to the operator or user of his equipment the full burden of the overhead, selling, and distribution costs. The manufacturer's profit would be no greater—competition and greater costs would likely make it less—and the operator's costs would certainly be enormously greater. The user would be faced with a pipe store, a mud store, a sucker rod store, a wire store, a fittings store, and dozens of others and a flock of salesmen from each, together with the costs of maintaining them all.

The distributor's place in the economic scheme is to reduce costs and increase efficiency for both the manufacturer and the user of the product. Consider the Bridgeport's position as a manufacturer and distributor. We manufacture the equipment that our facilities and experience enables us to produce economically. To reduce our distribution costs on these items and to be of greater usefulness to our customers, we distribute many products of other manufacturers. By spreading our selling, warehousing, administrative, servicing, and credit costs over the products of many manufacturers, we, like other distributors of a diversified line of equipment, perform an exceedingly useful and economical service for both the manufacturer and the user of oil field equipment. Our profit as a distributor, which is our remuneration for a useful service, is much less than the savings we bring to both manufacturer and user.

There should be no antagonism between the manufacturers, the distributor, and the user, for the welfare of each is the concern of the others. The user should buy his equipment as cheaply as possible, consistent with a return for the manufacturer and the distributor that will permit a fair return on capital, as well as permitting a part to be placed back into business for making and distributing better products at less cost, the benefits of which revert to the user in greater proportion than to either the manufacturer or the distributor.

[1]The topic "Rising Costs" is an editorial by A. A. Buschow, president of the Bridgeport Machine Company of Wichita, Kansas, in the April 1, 1937, issue of the *Bridgeport Bulletin*. The topic, "Your Position, and Ours—" is an article that appears in the same issue of the *Bridgeport Bulletin*.

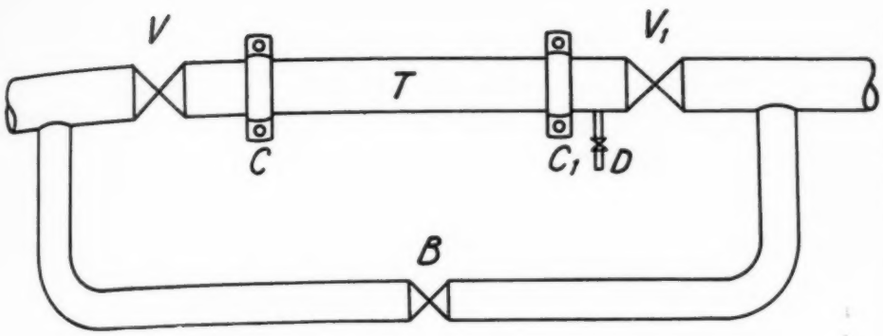


Fig. 1. Diagrammatic lay-out of trap section as incorporated in main line.

V-V_1 —Main line gates
C-C_1—Grooved end couplings
B —By-pass block gate
T —Removable section of line
D —One-inch drain line

Pipe Line Scraper Trap of Straight-Run Design

By ELTON STERRETT

REPEATED runs of a scraper through an 8-in. main line between the initial station and the first booster plant failed to bring about the desired and expected reduction in initial pumping pressure. The scraper would lose its effectiveness because of becoming clogged with paraffin early in its run, from which point on until taken out it would be useless. In fact the scraper acted as a swage or compacting device when forced ahead through the line and tended more or less to compact still more firmly the paraffin deposits lining the inside of the pipe.

In order to provide a scraper trap midway of this section and yet avoid the two or more offsets usually inserted in the main line by such a hook-up, advantage was taken of the ease of manipulation of standardized grooved-end couplings and these incorporated in the design of the trap. The chosen site on the line worked over for insertion of the trap, which provided a means of, as one pipeliner expressed it, "unbuttoning the line."

A sketch of the plan is shown in Fig. 1, whereby a section of the main line was cut out and an assembly consisting of two gate valves, two adaptor nipples, and a 4-ft. section of grooved-end pipe welded into the gap thus formed. One ft. beyond each of the valves the main line was tapped for the by-pass branch. Before cutting the steel, a 6-in. "weldolet" outlet was welded into place over the mark as previously laid out, and then with the cutting torch the original pipe wall included within the fitting was cut free. Onto these two welding fittings was then welded a by-pass line of the proper length, placing at its middle a 6-in. block gate valve.

Under normal pipe line operation gate valves V and V_1 remain open, by-pass gate B being left closed to cut down eddy currents within the branch and thus reduce paraffin deposition therein. The 4-ft. section T between the two couplings (of "Titeline" or "Victualic" type) simply floats between them, being under no tensional or torsional stress other than that induced by the flow of oil.

If a scraper is to be run from this mid-point to the first booster station, block gate valve B is opened and then the two 8-in. gate valves closed, after which the two couplings are parted and section T lifted out in order that the scraper may be inserted therein.

Fig. 2. Spring steel fingers of scraper closing or collapsing device shown within 4-ft. section to replace spacer in main line between two removable couplings. (Scale—2 in. = 1 ft.)

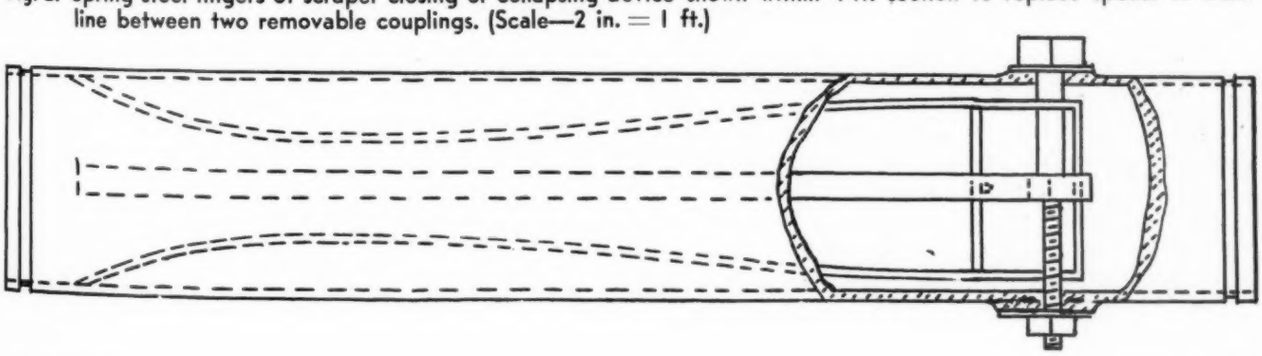


Fig. 3. Whatever its other failings, this angle junction is "kind" to scraper runs and prevents time- and money-losing "hang-ups."

Again in the line and the couplings made up—around new rubbers if the old ones show distortion or decomposition under the solvent effect of the crude—this section *T* serves as a cradle for the scraper until such time as it is desired to start it on its run. Then simply by opening the two 8-in. and closing the one 6-in. gate valve, in that order, line pressure is put behind the scraper and it begins to work.

This same type of hook-up might be used for removing the scraper when sent to the mid-point from the initial pump station, simply by fitting two blocks of wood, one to extend within the 8-in. adaptor nipple from the gate valve in V_1 to the parting at C_1 and the other to lie within the end of the section *T* to stop the scraper.

On this pipe line, however, with scraper runs scheduled every four days during the winter months and only half as frequently during hot weather, further advantage was taken of the flexibility of the couplings specified to use a straight-line scraper trap that, at the instant it caught the scraper, would depress the leathers and permit oil to pass around them—eliminating the common trouble of opening a trap and finding it so clogged with paraffin that the scraper had been unable to enter, either blocking the cut-off gate valve or even attempting to switch and follow the by-pass line.

A second section of line pipe, grooved on both ends and of the exact length of the standard *T* shown in Fig. 1, makes a scraper catcher body for supporting a spider formed from four lengths of 1-in. by $\frac{3}{16}$-in. spring steel, fixed at the back by a ¾-in. nut welded to the center of the transverse cross made by the two strips of steel. A 1-in. bolt, turned down and threaded ¾ in. to a point four in. below the head, passes through two reamed holes in the pipe, being screwed through the nut on the spider to center it in the pipe bore. A nut on the end of the thread outside the pipe locks the bolt in place and prevents leakage around the thread.

When a scraper reaches the spider—both main line gate valves being open—it is carried by the fluid column directly into the constriction formed by the four bow-shaped springs. As they reach the narrowed throat between these springs both leathers and their supporting plates are depressed or folded back, allowing oil to flow around the leathers and thus keep much of the loosened paraffin in motion.

As soon as the workman at the trap hears the scraper land, the by-pass gate valve *B* is opened, and at his convenience the two 8-in. gate valves may be closed and the scraper removed.

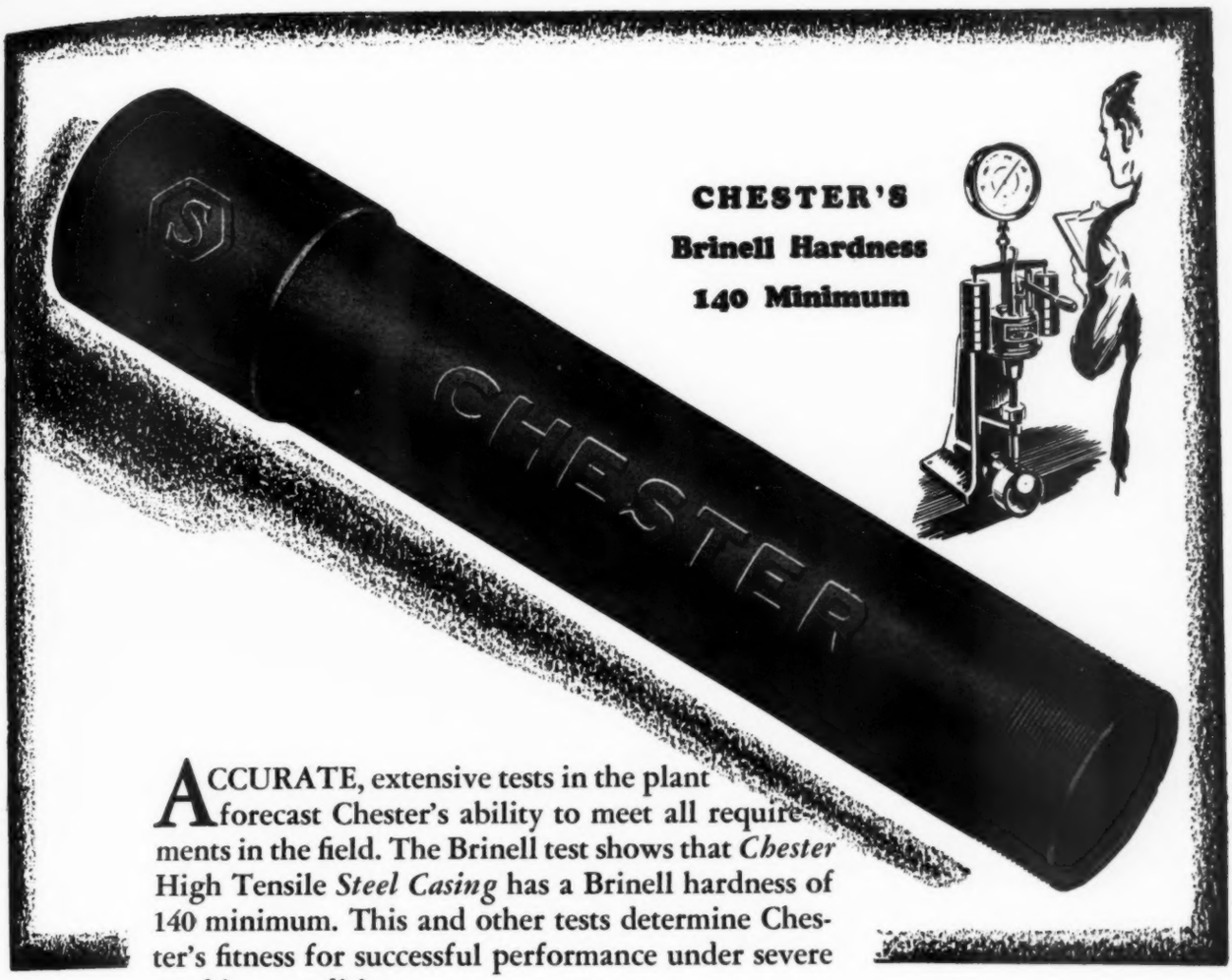
Bosses are built up by the welder outside the pipe and around the two holes for the one bolt that retains the spider and then faced off to take a lead washer under both head and nut, providing an oil seal and allowing the catcher to be used interchangeably with the section *T* under full pipe line allowable pressure.

To permit line pressure to be bled from the trap before removing the couplings that hold either filler section, a drain valve *D*, Fig. 1, is included in the set-up, being tapped into the adapter nipple connecting the outward gate valve (in the line of normal flow) with its corresponding coupling. Flow through the set-up, as illustrated in Figs. 1 and 2 is conventional, that is, from left to right.

Scrapers sent through this line were found to be remarkably free from broken centering arms, while those traversing other portions of the company's system frequently ended a run with from one to four or more of these attachments missing, and occasionally even with the scraper head distorted or split. Much of this breakage is ascribed to the fact that most branch or tap tie-ins, such as that of the by-pass around the scraper trap, are formed in the field, the welder first cutting a hole in the main line and then stabbing his outlet nipple into the aperture and welding it there.

The method described here forms an abrupt, right-angled surface against which the arm of an oncoming scraper must strike, instead of the first metal beyond the opening coming in contact with the notched wheel carried in its outer end. By using a "weldolet" at each end of the by-pass line for connecting it to the 6-in., the openings into the main line are tapered enough, due to the form of the fitting, to allow the toothed wheel to contact the metal and thus rotate, permitting the supporting arm to pivot on its pin and eliminate the sharp blow otherwise sustained.

Whatever their other structural and design weaknesses when used on lines carrying fluids under high pressure put up by plunger pumps, a junction with the included angle between lines of less than 90 deg., and as low as 45 deg., if possible, is easier on scraper passage than the right-angled joint, because of the wedging action of the converging slope of the branch serving to restore the expanded scraper section gradually to standard line circumference. If the initial pressure is put up by centrifugals or positive displacement rotary pumps, the pulsation that develops the weakness of such a junction is eliminated, and the tie-in more readily may assume this form.



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E. L. Moseley, 2218 Mills St., Houston, Texas.

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International Supply Co., Tulsa, Okla., and Branches.

Dunigan Tool and Supply Co., Breckenridge, Texas, and Branches.

Bridgeport Machine Co., Wichita, Kansas, and Branches.

Producers Supply and Tool Co., Marietta, Ohio; Fort Worth, Texas, and Branches.

Louisiana Supply Co., Sulphur and Brimstone, La.

Oil Field Equipment Co., San Antonio, Texas.

Industrial Supply Company, Inc., Wichita Falls, Texas, and Branches.

Okmulgee Supply Corp., Okmulgee Okla., and Branches.

Stephen H. McCabe, 508 4th St., San Francisco, Calif.

Viking Automatic Sprinkler Co., 114 Sansome Street, San Francisco, Calif.

Herley Supply Co., 3006 Cherry Ave., Long Beach, Calif.

Barde Steel Co., Seattle, Wash., and Portland, Ore.

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CHESTER

The Modernization of Electrical Dehydration Equipment

By FRANCIS D. MAHONE*

DURING the past several years considerable effort has been directed toward modernization of electrical dehydration methods and equipment for the purpose of making them more adaptable to conditions that have been encountered during this period, and to those anticipated in the future. Improved testing apparatus has been developed in the Petreco laboratory, and testing technique has kept apace. Two motor-laboratories have been equipped and placed in operation in California, and a mobile test unit has given satisfactory service in the Gulf Coast and Mid-Continent fields. This equipment is being used largely for flow-line testing in the field to determine the results that can be expected with commercial treating units. The engineering personnel has become increasingly familiar with modern lease conditions to the end that savings may be effected for the licensee and greater safety assured.

New treating tanks conform to the A.P.I.-A.S.M.E. code and now are available in two sizes. Both sizes can be used for either electro-flow or tank treating systems. The 10-ft. diameter size is the one that is most commonly used; the 5-ft. diameter size being developed to take care of small production. Improved electrode systems are in use, and more information is at hand for determining the type indicated for any given conditions. Entrance bushings have been re-designed so that there should be no electrical breakdown or leakage of oil at the flange, and a porcelain top has been provided to increase further the life of the bushing. Surge-proof transformers have been developed, and their adaptability for the peculiar and severe service of dehydration has been proven. One type of surge-proof transformer is provided with internal reactance, no external choke being required. Switchboards have been improved greatly; a new type board, designed for use with double-transformer units, is provided with two voltmeters, and the ammeter is fed through a current transformer. A simplified control panel mounted in a steel box is available for single-transformer units. No switch-house is required for this board. All new panels are equipped with the most modern type of switches and have been approved by the Underwriters' Laboratories.

In addition to the foregoing mentioned improvements in equipment, studies have been made and their results published[1] in an effort to enable Petreco licensees to obtain the greatest economy in the handling of their production from well to pipe line.

It is believed that the most important recent step in progress for the benefit of licensees has been the development of Electroflow (flow line) treatment. As its name implies, this system provides that the wet production flows directly through the gas trap and the dehydrator to the shipping tank, arriving there in the most favorable condition for marketing. In some instances, the application of heat is required between trap and dehydrator, although, usually, well temperature is sufficient for proper dehydration. It is apparent from the simplicity of the process that great economy and

*Design Engineer, Petroleum Rectifying Company of California.
[1]See references at end of article.

Fig. 1

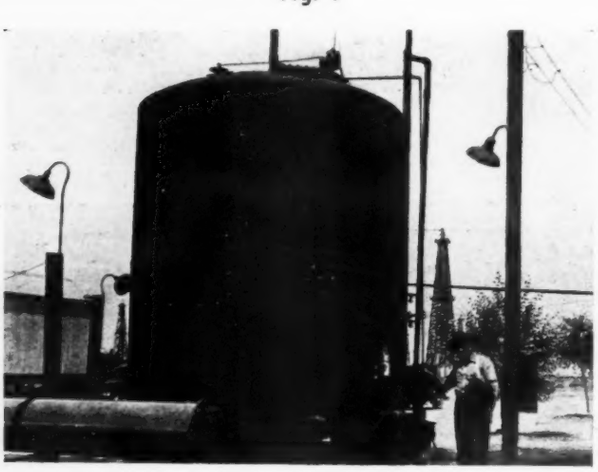
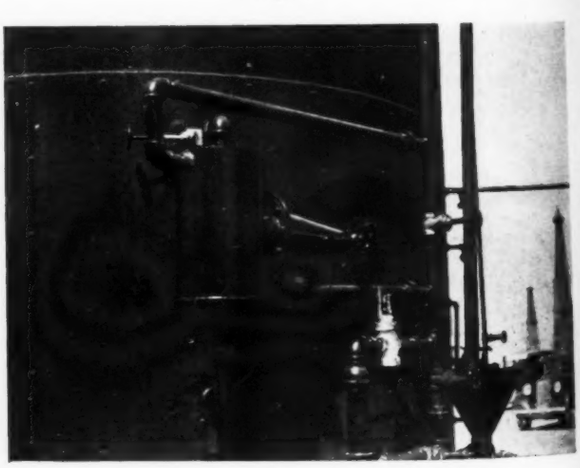


Fig. 2



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efficient operation would be obtained by the utilization of waste heat, when required, and the use of automatic control.

A large number of plants have been installed or put in operation recently on the flow line system with automatic control. Usually the treating tank is one formerly used on batch treatment on the same or some other lease. A unit in the Mountain View field is presented here. Fig. 1 shows the treater. Fig 2 gives an enlarged view of the automatic water level control apparatus; and Fig. 3 shows the boiler-type heater with thermostatic control. All material for this installation except the dehydrator itself, was salvaged from the lease. Four large stock tanks, required with batch treatment, were salvaged. No heating is necessary in summer. The gravity of the treated oil has been raised two deg. A.P.I. over that obtained by the batch process with a corresponding increase in price of ten cents per barrel. The installation requires no attention at night.

Fig. 4 shows another Mountain View Electroflow plant. The chamber on the outlet line at the top of the dehydrator is for taking care of surges and gas from the wells. This surge chamber assures that the treating tank always is full of liquid. Fig. 5 shows the automatic water-level control on this unit. During cold weather some heat (110 deg. fahr.) is supplied by a boiler heater with thermostatic control. Treated oil cuts average 0.1 to 0.2 percent.

Fig. 6 shows a two-unit installation in the same field. Surge chambers and automatic water-level controls are part of this equipment.

A Signal Hill Electroflow installation has been made recently in which five wells are manifolded ahead of the treater, and the cleaned oil goes directly to stock. No heat is required, and a slip-type siphon bleeder maintains constant water level in the dehydrator. The manifold at the electric dehydrator is made in such a manner that any of the wells can be produced into a small tank for gauging purposes. The oil from this tank is then pumped back into the flowline and dehydrated with the regular production after gauging. While a gauge tank is used in this particular installation for gauging purposes, other installations have used oil meters for the same purpose. Oil meters can be obtained that will work at the pressure at the manifold so that the oil that flows through the meter is again forced back into the common line to the dehydrator without any additional pumping. This is an example of a very simple and efficient plant.

Fig. 7 shows a four-unit plant in the Mt. Poso field, California. This installation is not operated on flowline, but heat is supplied by exhaust steam, and solenoid-operated valves control the water level in the dehydrators. A close-up of one of the automatic valves is shown in Fig. 8. The dehydrator tanks comprising this plant were salvaged from other locations, and the installation has been modernized so that

Fig. 3

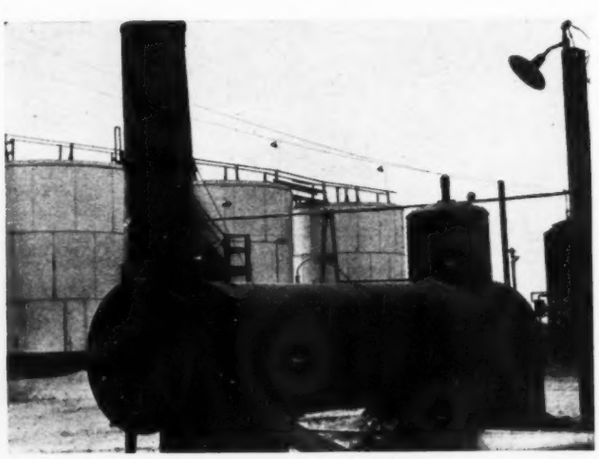

Fig. 4

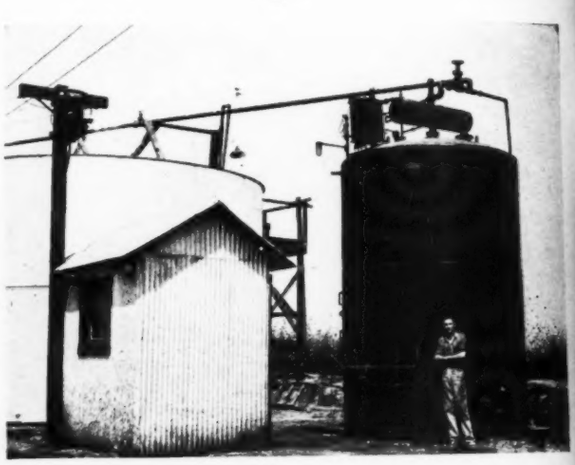

Fig. 5

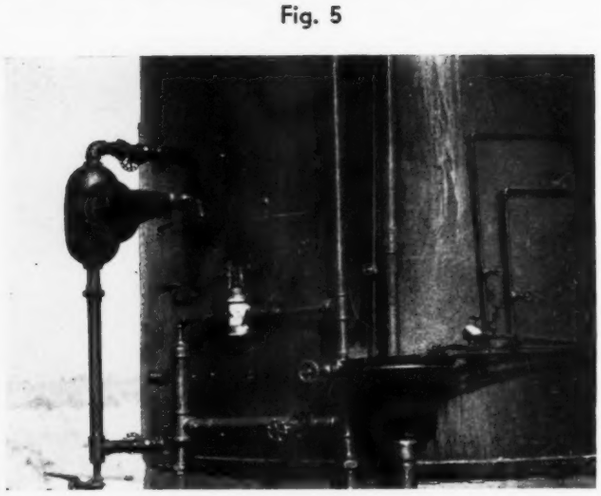

Fig. 6

THERE'S OUR OIL SAND
NOW CALL JOHNSTON
AND WE'LL SEE
HOW GOOD IT IS!
The Johnston Tester is ACCURATE because an exclusive Trip Valve prevents contamination of test fluid by drill pipe leaks.
The Johnston Tester is SAFE because a patented Equalizing Valve (used under Exclusive license) absolutely equalizes the pressure above and below the packer before it is lifted from the seat.
The Johnston Tester is FAST IN OPERATION because its valves function automatically by merely lifting or lowering the drill string.
Furthermore, a depth pressure recorder—a part of every run—gives a permanent pressure record from the time the tool starts in the hole until it comes out again.
WISE geologist, like a smart doctor, knows when to call a specialist, and Johnston's specialty is accurate and reliable formation testing. An oil sand may be a world beater in the core tray, but on production won't have enough kick to pop your hat off. Another sand — a small, unimportant looking stringer, may prove to be the big producer in your well . . . so don't pass up ANY oil sands and don't set ANY casing until you KNOW, and it's Johnston's job to find out!
"WHY SET CASING BEFORE YOU KNOW?"

Fig. 7

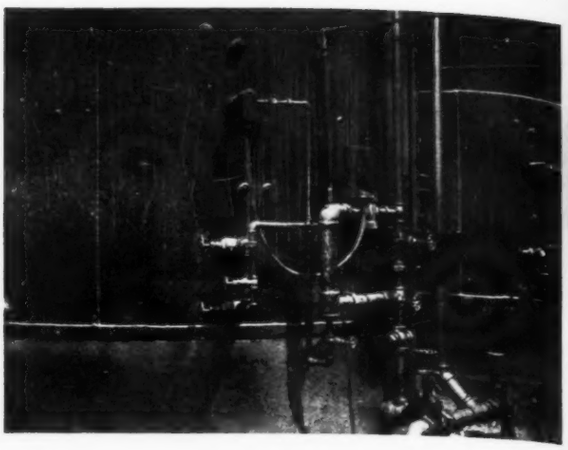

Fig. 8

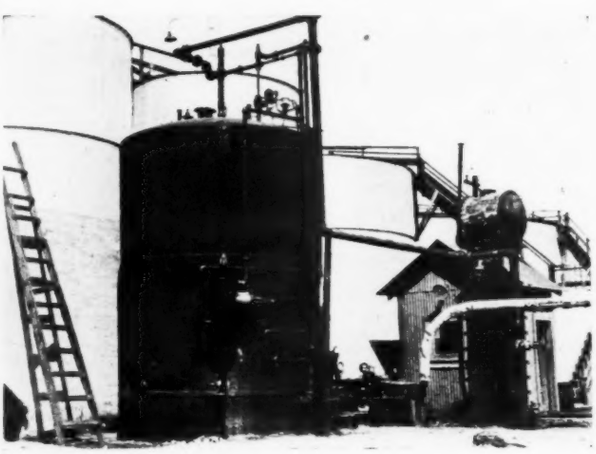

Fig. 9

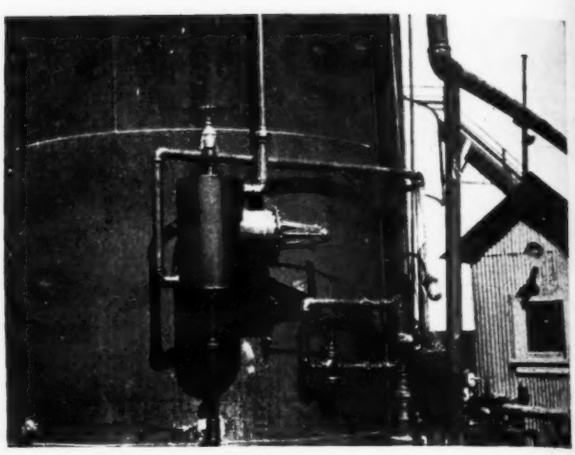

Fig. 10

its present throughput is about 300 bbl. an hour to 0.5 percent dry cut, or 600 bbl. an hour with a 2.0 percent cut.

A plant in the Kern Front field, California, recently was installed for automatic operation. A motor-driven pump with variable speed control delivers the wet oil from the gathering tank through an indirect flame heater provided with thermostatic control, to the dehydrators and thence to the shipping tanks. Solenoid-operated water valves maintain a constant height of interface in the treaters. As the wet oil feed pump can be set to operate at a definite throughput and the temperature to the dehydrator and the water level in the dehydrator are all controlled automatically, this plant requires very little supervision except a checking of the automatic controls at intervals to see that they are functioning properly.

Another plant, not on flowline, recently has been modernized. Production on this property is delivered to a wet oil tank by the wells or by tail pumps. A tail pump on an adjacent well moves this wet oil through a heat exchanger and a boiler heater with thermostatic control to the dehydrator and thence through the other side of the exchanger to the shipping tanks. A float in a water-jacketed cage operates a balanced valve to maintain constant water level. At the time this plant was modernized, no new equipment was required. The dehydrator, heat exchanger, and tank were on the lease; one of a battery of steam boilers was converted into a heater, and a pumping well was utilized for power. This dehydrator is shown in Fig. 9 and a close-up of the water-level control in Fig. 10.

Reclaimed dehydrator tanks, reconditioned and equipped with the latest and most appropriate type of electrodes and with automatic controls, are available at a cost that, added to that of auxiliary equipment salvaged on the lease, makes the total first cost very moderate, and often less than the value of lease tanks, pumps, boilers, etc., that no longer are required and which may be sold or used elsewhere.

The installation of the correct type of electrodes for given conditions almost invariably reduces operating costs and also enables the licensee to obtain greater returns for his production, as gravity and volume losses are minimized.

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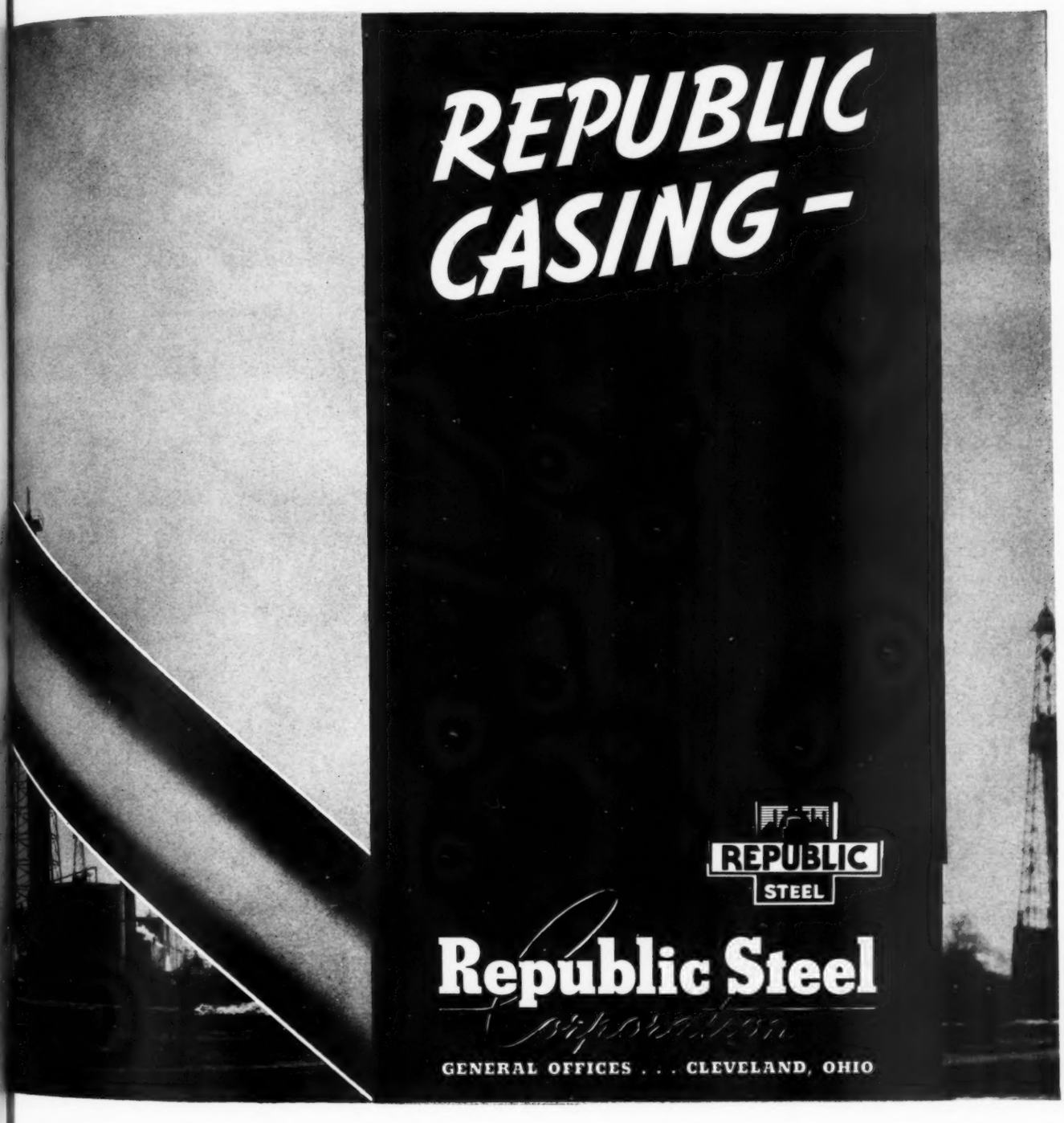
PROFIT AHEAD

for the producer who uses



Magnetic Method of Orienting Cores

Its Advantages in Determining the Dip and Strike of Subsurface Strata

By G. L. KOTHNY*

IT has long been customary to obtain samples from the earth's strata by employing diamond core drills or core drills of other types either rotary or percussive. Attempts have been made, by orienting the core barrel out of the bore hole or by attaching gyroscopic and magnetic compasses to the core barrel and by various other means, to "orient" the core or determine its original position in the earth. When this fact is known the dip and strike of subsurface strata intersecting the core, so that traces of it are shown on its outer surface, readily may be determined.

Such methods have several very evident disadvantages. It is necessary to suspend regular drilling while special runs are made with orienting core barrels, and such runs must be repeated until a core showing satisfactory bedding planes is procured. The work can be done only for the immediate strata that are being penetrated by the core barrel. In other words, *strata already penetrated*, even though the cores may be available, *are closed books* so far as these methods of obtaining their dip and strike are concerned.

It has been discovered that most sedimentary rocks have a slight permanent magnetic polarity in the direction of the earth's magnetic field. This does not apply to pure limestones, anhydrite, or salt, but to sandstones and shales of normal iron content in which small particles of magnetic minerals derived from older rocks have been more or less oriented in the earth's field while settling through water, and have been magnetized further through standing in this field for millions of years since they were laid down.

Sperry-Sun Well Surveying Company recently opened a laboratory for orienting cores, and reliably determining the dip and strike of any intersecting bedding plane. The method utilized is covered by U. S. Patent No. 1,792,639, and several pending applications.

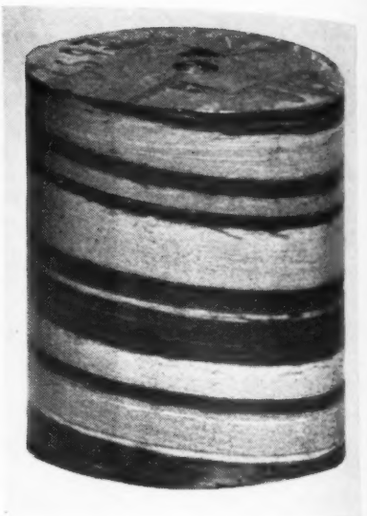
This method covers determining the magnetic polarity of the core samples, that is, the direction in which the earth's magnetic field has magnetized the samples, orienting the samples to correspond with the original position in the earth, and measuring the dip and strike of the stratification in the core.

The information is obtained by means of a highly-sensitive magnetometer that automatically and photographically records the polarity of the core samples. The information rendered is the average orientation of the bedding plane of the samples submitted in a set of not less than three or not more than five.

Although it is preferable to receive fresh cores, cores that have been removed from the well for long periods may be used so long as they have not been exposed to magnetic influences and so long as the top or upper end of the core is shown accurately.

By this method it is not necessary to interfere with the progress of drilling. Core showing satisfactory bedding may be selected from the trays containing the cores taken by standard rotary core barrels in the ordinary course of drilling, and can be oriented by an

*Vice-president, Sperry-Sun Well Surveying Company.



Sample of a core ready to be put in the apparatus for determining the orientation

Typical examples of the types of cores used for determining the orientation

now . . .
the "Sunshine Process"
(ADDITION OF VITAMIN D)
makes good
Bread and Milk
BETTER

now . . .
the Preforming Process
makes good Wire Rope *BETTER*

● The addition of Vitamin D concentrate gives food the life-giving value of sunshine. A basic improvement to an age-old product.

Preforming gives wire rope the life-giving value of relaxation. A basic improvement to a century-old product.

Preforming relaxes wire rope. It puts all component wires and strands in a state of ease. They are comfortable, unstrained, flexible. Preforming thereby tends to eliminate the destructive internal torsional stress, tends to reduce crankiness and kinkiness.

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investigation of their magnetic properties provided their upper end is known. To determine the dip and strike of the strata in which they lie it is necessary also that some indication of a bedding plane be visible on the body of the core. This may be a line of foraminifera, a fracture, or any other indication of a bedding plane.

It is not necessary that any special equipment be available at the well as *cores may be shipped from any distance* to the laboratory where the determination is made.

The method of service is as follows: One set of not less than three and not more than five samples of preferably fresh cores *with visible indications of a bedding plane* obtained from within a range of depth of 30 to 50 ft., carefully packed to avoid breakage, is mailed to the laboratory at 549 East Bixby Road, Long Beach, California. The samples should be accompanied by a letter stating the depth at which they were taken, also identifying the well by a code number and its approximate location by naming the field, county, and state. The inclination and its direction of that part of the hole from which core samples originate also should be given.

The samples must be not less than 2-in. diameter and 3 in. long, between ends, perpendicular to the axis. Samples of larger sizes are preferable.

Samples must be marked "top" and "bottom." This is important, otherwise the direction of the bedding plane might be reversed by 180 degrees.

A comprehensive report on the findings is delivered to the customer at the earliest possible moment. The fees for this service are very reasonable, the cost of one determination of the orientation from a set of three to five sample cores being $150.00.

The service is absolutely confidential. This method has been applied to cores from all sections of the United States and it has been found that satisfactory determinations can be made in more than 60 percent of the cores submitted. Where cores show so little magnetic polarity that accurate determinations cannot be made a refund arrangement is provided so that a part of the fee charged may be applied to a subsequent determination.

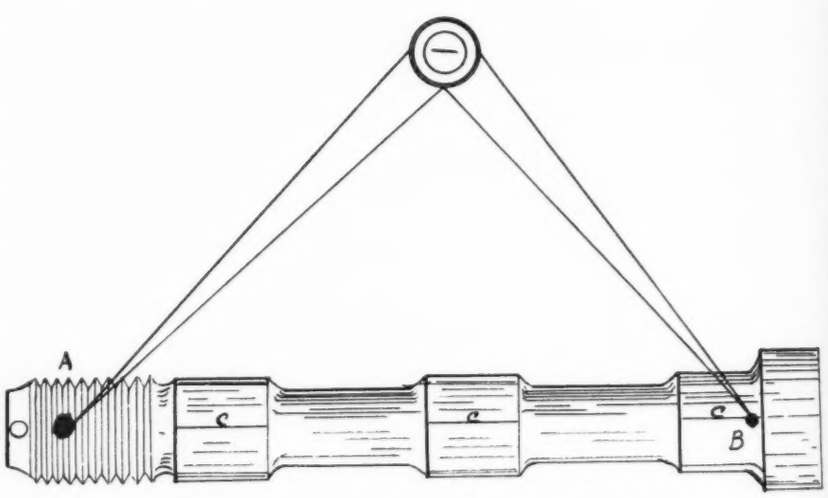
The value of knowledge of the direction of dip is evident to any experienced operator, not only in the case of wildcat wells and core holes to determine structure, but in proven areas to determine when wells have passed through faults or crossed the axes of symmetrical anticlines into areas from which they should be deflected.

Stretch and Twist in Bearing Bolts

By JOS. L. INGRAM

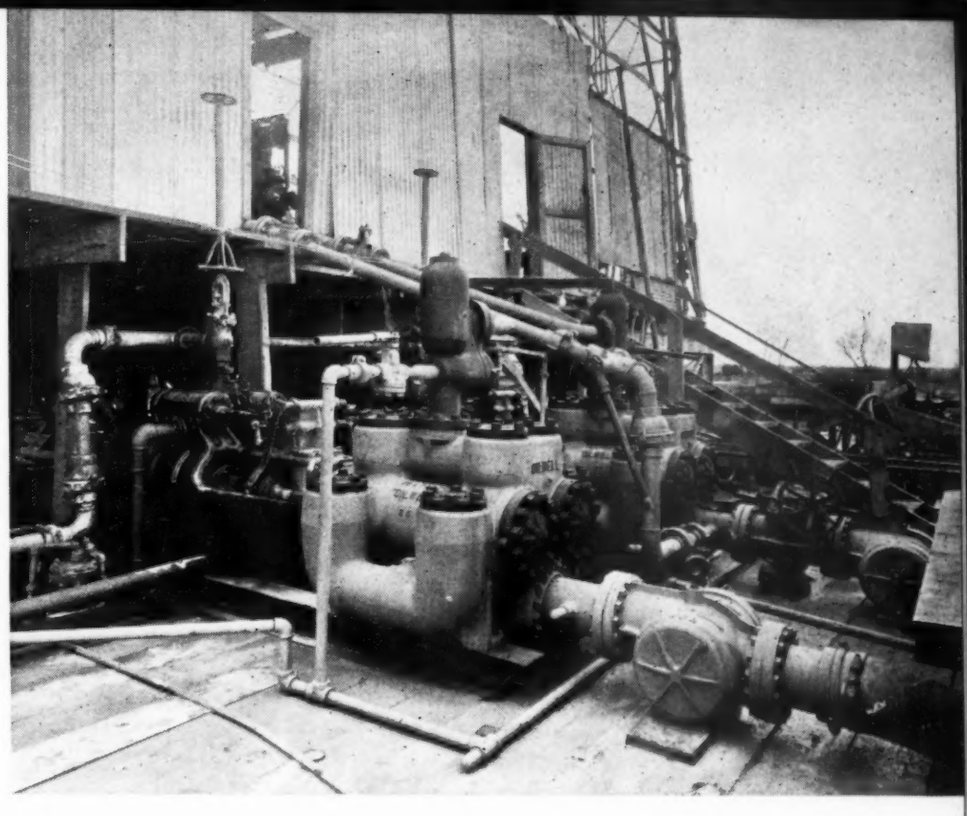
RECENTLY visiting a plant in which the engines were being reassembled after a general overhaul, the writer noticed two men alternating on a 16-lb. sledge hammer in tightening the crank-bearing bolts. Apparently no markings were visible at any place on the bolts or nuts to indicate how far they were being brought down or where they were before taking down. The chief engineer assured those interested that bolts the size of these would not stretch or twist, and that if they did, a large pair of micrometers would be necessary to determine the amount.

Contrary to the belief of many good engineers and maintenance men, crank-bearing bolts do stretch, and they also twist. In many instances, the stretch or twist may be such as to cause the bolt to take a permanent set. Though it is reasonable to assume that certain amounts of both types of stress are permissible, the utmost care should be exercised to prevent an excess of either. When the stretch in a bearing bolt is discovered to be more than two percent of its total length, or the twist is found to be more than one-eighth of the bolt's diameter, the bolt should be considered unsafe and discarded. A new bolt is cheap insurance. Excessive bolt twist or stretch may pass unnoticed until excessive pounding arising from extreme bearing wear or additional forces of inertia cause the bolt or bolts to fail while the engine is running. It stands to reason that a bolt will fail from overstress. If the load is beyond the yield point of the material it will not return to its original length when the nut is unloosened. If this condition is permitted to continue the bolt will continue to stretch under the load until finally it breaks.



Marking the bearing bolt for stretch and twist

A permanent marking that will indicate either stretch or twist, can be made without expense. By making two marks with a sharp center punch at points A and B as shown on the accompanying drawing the distance between A and B can be measured with a pair of dividers. This measurement will indicate whether or not the bolt fails to return to normal; it also will prove useful as a record during future overhauls. By using a straightedge or square, a straight line can be scribed the entire length of the bolt. After the bolt has been tightened placing the square along this will indicate how much, if any, the bolt is twisted.



Slush pumps on Hamman Exploration Company's rig in the new South Bay City field. Note the 10-in. gear-operated plug valve on one suction line for quick change when pumps are to be compounded

A brief description of drilling and completion methods in this new deep field

By

JOS. A. KORNFELD

Development Practice in the South Bay City Field

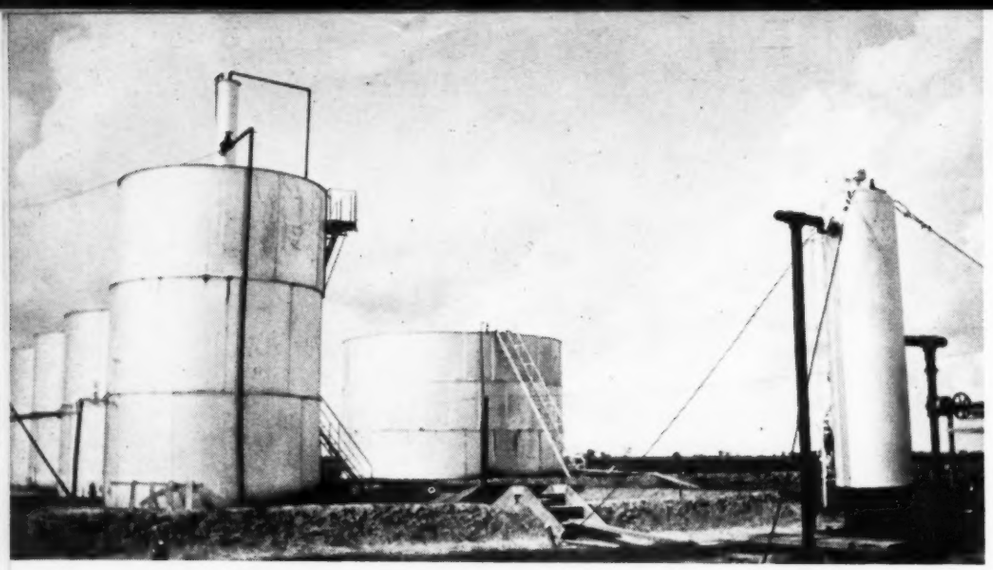
SUCCESSFUL gun-perforation practice and squeeze-job cementing at depths ranging from 8190 to 9361 ft., wire-line coring under pressure, and the employment of vertical steam-drilling engines operating on steam of 300-lb. pressure, 136-ft. steel derricks, and heavy-duty equipment including 20-in. slush pumps with compounding arrangement, are features of modern development practice in the new South Bay City oil field of Matagorda County, Coastal Texas. Operators generally have adopted a program that calls for the thorough coring of all strata of Oligocene sand, the chemical analyses of the salt water content of cores and mud, the rechecking of depth measurements, and careful completion methods that make possible the bringing in of wells after washing without resorting to swabbing.

Typical well-head installation in the new South Bay City field. This is the discovery oil well

The geologic structure of the South Bay City field is a deep-seated dome situated within the salt dome province of the Gulf Coast embayment. It is one mile south of the town of Bay City, county seat of Matagorda, and 21 miles from tidewater. Subsequent to reported showings of oil in nearby shallow tests and slight topographic irregularity, the structure was revealed by a reflection seismograph geophysical survey made in August, 1935. Development followed two months later.

The discovery well, Hamman Exploration Company's No. 1 Mrs. May Cleveland, situated on a 68-acre tract in the E. Hall survey, was brought in February 29, 1936, producing from a depth of 9361½ to 9370 ft. through 19 holes perforated in the 5-in. liner. At the time of completion this well set a new record for producing depth in the Coastal Texas area, exceeding by 200 ft. the existing depth record. Initial production was obtained without having to swab, as the well came in immediately after thorough washing was completed. On its initial test the well produced at the rate of 270 bbl. of oil a day of 34.5-deg. A.P.I. gravity (corrected for temperature) through a 3/16-in. choke and under a tubing pressure of 850 lb., and a casing pressure of 1060 pounds. The productive horizon is the Frio sand series of the Oligocene, found 1347 ft. below the top of the series. The bottom of the discovery well is near the center of the highest closure indicated by the geophysical survey.

The field was extended one-half mile north on March 20, 1937, more than a year after the discovery well was completed, when the Hamman Exploration Company completed its well No. 1 J. H. Crooker in the E. Hall survey. Like the discovery well, it was completed through gun-perforations, although the casing was gun-perforated in this well instead of the liner. Pro-



View of separator, typical tank flow battery, and lease storage tank on the discovery lease

duction is obtained from 8190 to 8194 ft. through 19 perforations in the 7-in. casing, which is set at 9575 ft., total depth. While being cleaned this well produced 650 bbl. of fluid a day. On completion it produced through a ¼-in. choke 470 bbl. of fluid a day, of which from four to eight percent was salt water. Previously, by gun-perforating the casing, salt water had been found at 8806-8619 ft., 8832-8836 ft., and from 8944 to 8949 ft., all in the Frio sand series of the Oligocene. This well opened a second producing zone for the structure that was 1171 ft. shallower than that found in the discovery well.

A location for the third test well has been made 2400 ft. south of the discovery well. It is the No. 1 J. E. Thompson of the same operator who drilled other two wells, and is situated on a 189-acre tract in the E. Hall survey. A continuous development program is anticipated by the discoverers of the field.

The casing program to be employed for the present is as follows:

Surface string

13⅜-in. ..... 1260 to 1400 ft.

Protection string

9⅝-in. ..... 6500 ft.

Oil string

7-in. ..... 8190 to 9361 ft.

Coring begins below 5300 ft.; all sands below this depth to the bottom of the well are cored, the conventional type core barrel and wire-line barrel being used. As many as 127 cores were taken from No. 1 M. Cleveland, the discovery well. Ether tests and chlorine content tests are made of each core immediately after recovery. On the most favorable cores, saturation tests are made.

Drill pipe employed is of 4½-in. O. D. 16.60-lb. special alloy grade D, range No. 2, with Acme thread 3 5/32-in. I. D., 5¾-in. O. D. tool joints, in conjunction with a 41-ft. 4¼-in. kelly joint of S.A.E. 3140 steel.

Most of the steel derricks in use are 136 ft. in height and have a 30-ft. base, and are designed for a capacity load of 800,000 lb., while that of the sub-structure is for a 1,000,000-lb. load.

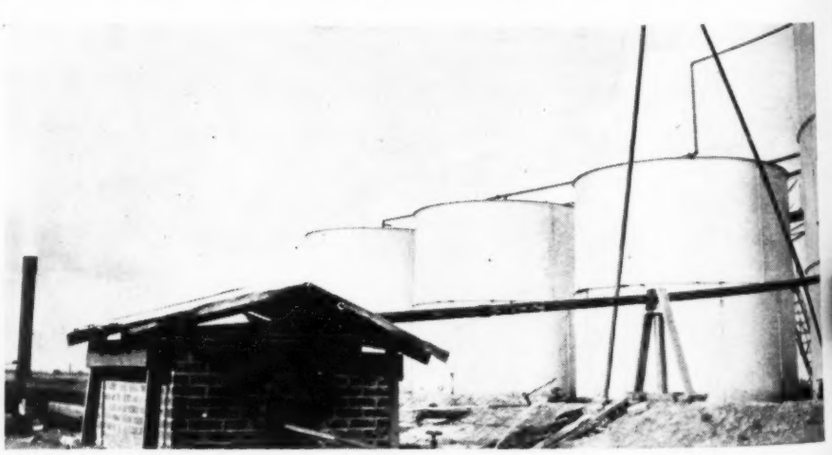
The pressure-control hook-up consists of two 13⅜-in., 6000-lb. test, blowout preventers, one equipped with blind rams and the other with rams to fit the drill pipe. A 7-in. pressure-operated gate valve is placed on the flow line.

The boiler battery consists of three 100-hp. boilers, which are equipped with low-pressure gas burners and have a working pressure of 300 pounds. The boiler feed unit consists of one 10-in. by 4½-in. by 10-in. boiler feed pump, one 5-in. by 10-in. by 6-in. by 12-in. feedwater heater and pumping unit, and two 5-kw. electric generators. The boilers are equipped with a "Meco" firing control, mounted on a skid-type base, and a stack blower control. The firing control is set to maintain a uniform pressure of 300 lb. at all times on the steam line. The boilers and the boiler-feed pumps are so placed that a minimum number of bends is required, resulting in an increase in overall efficiency of the boiler plant and a reduction in investment for fittings.

The slush pumps, steam-driven, consist of two 15-in. by 7¾-in. by 20-in. units, the arrangement of which is such that they can be controlled from the derrick floor, requiring minimum time for changing from one pump to the other. Compounding of the slush pumps is simplified by the use of a 10-in. gear-operated plug valve in one suction line; this method of opening and closing valves for compounding is a decided advantage over the old method of breaking a union and inserting a bull plug. This is shown in an accompanying illustration.

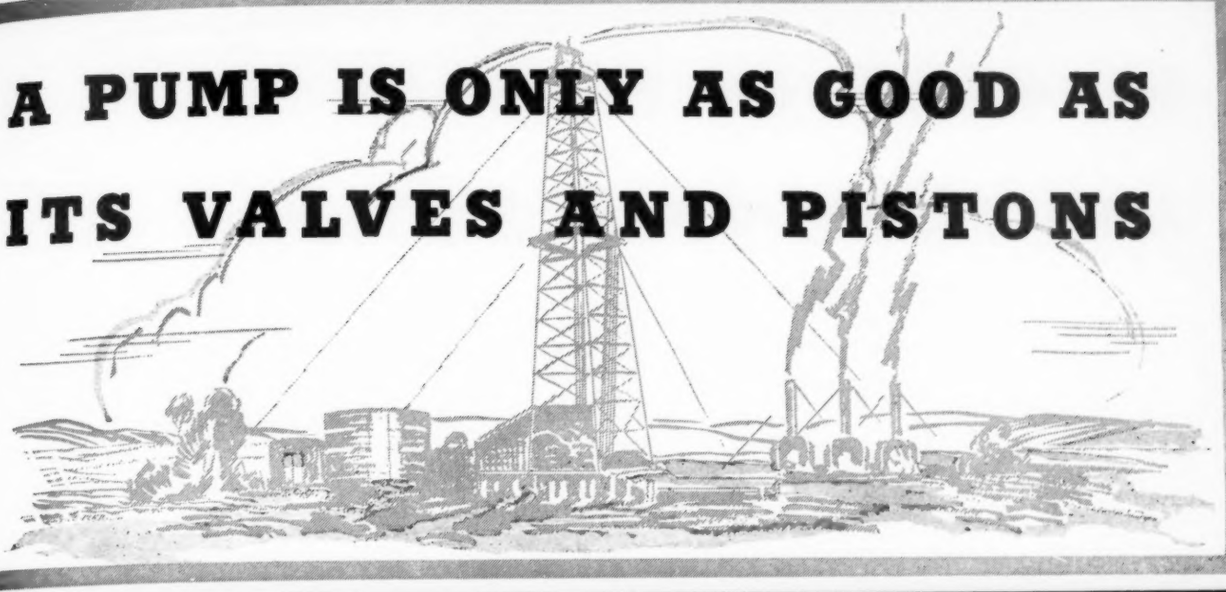
The drilling engine is a 12-in. by 12-in., vertical twin-cylinder center-drive steam-operated unit. The rotary table is of 27.5 in. diameter, and the hoist is equipped with an Hydromatic brake. In the derrick is placed a standby or auxiliary standpipe and rotary drilling hose, which is connected to a circulating head and valve so that, should the well threaten to blow-out when the kelly joint is in the rat hole, this auxiliary head can be made up on the drill pipe and circulation established, thus providing an additional safety factor for these high-pressure wells. This arrangement also allows the wire-line core barrel to be pulled under pressure.

Crude oil production is gathered



Heater for treating oil in use on the May Cleveland lease in the new South Bay City field

A PUMP IS ONLY AS GOOD AS ITS VALVES AND PISTONS



NEW MISSION SILVER TOP SLUSH PUMP VALVES LAST 100% LONGER

- **Time-proven Mission Principle of wear-taking removable bushings in a long-lasting seat**
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- SAVES MONEY FORMERLY INVESTED IN CONTINUOUSLY BUYING NEW SEATS.
- **NEW BUSHING IS TAPERED**—a progressive Mission improvement that holds the bushing firmly in place, eliminating wear on bottom of bushing, and valve seat under bushing . . . Easily changed by using attachment on Mission seat puller.

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- SAVES MONEY FORMERLY INVESTED IN CONTINUOUSLY BUYING COMPLETE NEW PISTONS.
- LIFE OF LINERS AND PISTONS INCREASED.
- Principle of more-rubber and less-metal gives far greater wiping surface . . . eliminating by-passing.

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from the two completed producers and boosted through a 2-in. line to a loading rack 4000 ft. north of the discovery well on the right-of-way of the Santa Fe railroad. It is then shipped via tank car to The Texas Company refinery on the Ship Channel at Houston. A 5000-bbl. lease storage tank has been erected on the May Cleveland discovery lease.

Gas production is handled through a 2½-in. gathering line that connects with the main line of the Houston Oil Company's coastwise trunk system.

The principal geologic horizons penetrated in drilling are as follows, (it is the customary practice to core paleontological markers for accurate determination of the depth of principal contour markers):

Marine Miocene	6390 ft.
Oligocene Discorbis	6386 ft.
Oligocene Heterostegina (lime)	7002 ft.
Oligocene Marginulina	7435 ft.
Oligocene Frio (lithology)	8014 ft.

The depths given above are those at which these zones were reached in the discovery well.

Lane-Wells Company Purchases Alexander Anderson, Inc.

EFFECTIVE April 1st, the Lane-Wells Company announces the outright purchase of Alexander Anderson, Inc., for an undisclosed consideration. Both companies have long been well and favorably known in the oil industry. The contributions made by Alexander Anderson in his development of various methods of surveying drilling wells, as well as the various contributions to directional drilling control, are outstanding.

Purchase of the Anderson interests marks another forward step in the aggressive expansion of the Lane-Wells Company during the past few years. The operations of the Lane-Wells Company and subsidiaries have been international in scope for some time. The various tools, instruments, and methods of Alexander Anderson, Inc., have been used in foreign fields since 1927, but the actual field service, initiated by the company in 1924, has been confined to California. Under the guidance of the new management, Alexander Anderson services will be strengthened by the research activities of the Lane-Wells Engineering Department and will become international in scope.

The Lane-Wells Company recently completed what is generally regarded as one of the most modern and up-to-date plants of its kind in the industry today. In its construction, architects and engineers have provided space and facilities permitting expansion such as is involved in this particular case. The plant equipment and laboratory facilities of Alexander Anderson have increased during the past 13 years to a point where, even with the space and facilities provided by the Lane-Wells Company, it will be necessary to erect new buildings to house them. As soon as these buildings are ready, at 5610 Soto Street, Los Angeles, California, all plant and service equipment will be moved from Fullerton to the new location.

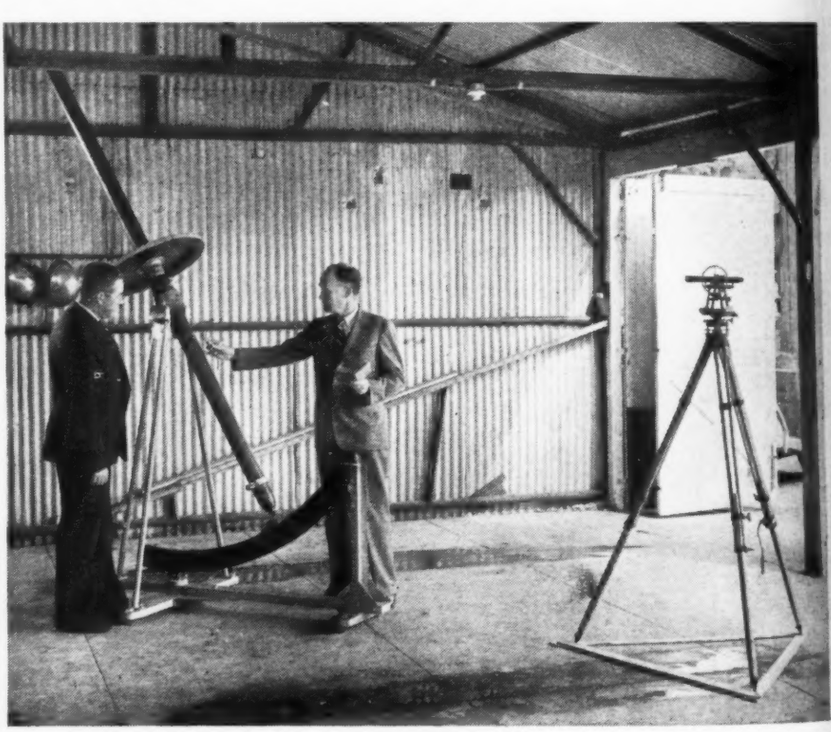
Walter Wells, president of the Lane-Wells Company, in speaking of the purchase said: "We feel that our acquisition of Alexander Anderson, Inc., enables us to offer the oil industry what is possibly one of the most complete services of its kind in existence at the present time. Anderson's well-survey equipment, devices and patents, covering all phases of checking on the progress and completion of drilling wells, rounds out the Stratagraph and Gun-Perforating services now offered by our own organization."

With the addition of Anderson's experienced staff and full line of surveying instruments, the Lane-Wells Company soon will be in a position to supply high-grade services in permanent field headquarters for drilling and production operations.

No changes will be made in the personnel of the Alexander Anderson organization, which numbers 58 persons at the present time. It probably will be expanded to keep pace with such demands as increased business may put upon it.

Mr. Anderson, to whom the entire industry is indebted for the development of various inventions and patents, plans to retire and devote his time to other interests.

According to Wells, the plant facilities of Alexander Anderson will be used to house the operations of that division of the company until additional buildings have been erected for them at the Lane-Wells plant. The main office at Fullerton and branch offices at Bakersfield, Long Beach, and Santa Barbara will be under the direction of the men who long have been identified with the Anderson organization and who know intimately all phases of well survey and directional drilling control.



"—Goes round and round and comes out here." Walt Wells, president of the Lane-Wells Co., is being shown by Alexander Anderson just how the Anderson underground instruments are tested

WHAT OIL MEN ASKED FOR

TWO PORTLAND CEMENTS —BOTH MADE FOR OIL WELLS

OIL-WELL work presents special problems which all-purpose cements were not designed to meet. Recognizing this fact, more than a decade ago Lone Star Cement Research Laboratories perfected 'Incor' 24-Hour Cement, which sets normally but hardens in one-fifth the usual time—the high early strength cement with an outstanding record of successful results in oil-well work.

Meeting Oil-Well Needs

Then, closely following oil-field developments, Lone Star met the newer problems presented as wells became deeper and hotter. And 'Starcor' Cement was perfected.

Both 'Starcor' and 'Incor' are true Portland cements, in all that the term implies. No admixtures or adulterants are used or needed. By carefully perfected processing methods, the needed special properties are built into the cement itself.

Thus, both 'Starcor' and 'Incor' pump easily in 15- or 16-lb. slurries. Stay gel-like to resist mud contamination. Provide a stronger, denser shut off.

Controlled Setting Time

And both cements have controlled setting time—an in-built safety factor to allow the slurry to get to the bottom of the well, with ample leeway for unforeseen contingencies. 'Incor' is "timed" for cementing wells of medium depth, while 'Starcor' is timed to set slowly in even the deepest wells, in the presence of high temperatures.

Then, while timed to set normally, both 'Starcor' and 'Incor' harden rapidly and thoroughly, once they are in place, and provide quick protection against gas agitation and ground-water seepage. You can drill out in 1 to 2 days with 'Incor'—2 to 3 days with 'Starcor'.

And both cements resist sulphate-water action, 'Starcor' being specially designed to provide extra protection where these conditions are serious.

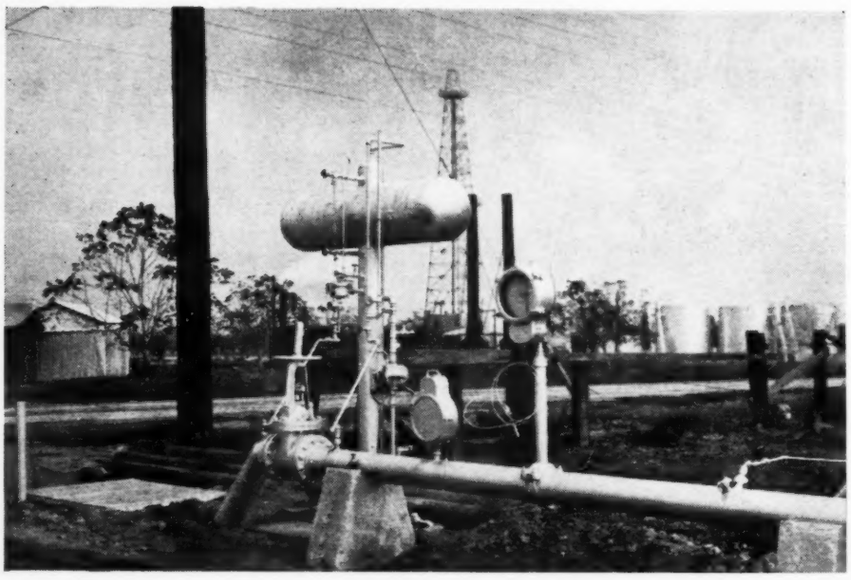
Record of Dependability

Here, then, are two oil-well cements, made just as oil men wanted them made. Backed by Lone Star's 37-year record for unvarying quality and uniformity. Use 'Starcor'* or 'Incor'* on your next job. Both are stocked by Lone Star Dealers, for immediate service. Lone Star Cement Corporation, Dallas—Houston. Cable address: Cementus, Dallas.

*Reg. U. S. Pat. Off.

ENT CORPORATION

24-HOUR CEMENT • 'STARCOR' CEMENT



Type of equipment used by the Southern Counties Gas Company to odorize stripped casinghead gas as it enters the main transmission line at Montebello, California

Odorizing Stripped Casinghead Gas

By J. C. ALBRIGHT

Equipment and methods used by a large gas distribution company in California

NATURAL gas, or more properly speaking, processed casinghead gas, handled in the transmission lines of the Southern Counties Gas Company, produced in the Montebello extension pool north of Pico, California, is odorized as it leaves the gasoline plants and before it enters the main lines of the transmission company. The receptacles for holding the stenching material are standardized insofar as design is concerned, differing only in the capacity of the units used at various places.

A representative unit, shown in the accompanying illustration, was installed on the gas line leading from the gasoline plant of the Universal Oil Company in the Montebello extension, erected above the meter run, which was constructed with sufficient length to accommodate the metering equipment, temperature recording instruments, and the odorizing unit. Concrete piers, or supports, were run in a form beneath the meter run to prevent sagging and vibration.

The receptacles are cylindrical in form, and are attached to a pipe standard welded to the central part of the body, or tank. The upper part of the standard is equipped with a partition, fluid tight, to act as a lower section of the reservoir, so that the sight feed instruments may utilize all the fluid in the receptacle. A gauge glass and fittings are used to enable the line walker to determine when the vessel requires refilling.

The cylinders are charged by pumping the stenching fluid from the original containers, or from barrels, by means of a small hand-operated gear pump, permanently attached to the unit. Piping is connected from the discharge of the small pump to the "dome" of the cylinder in order that the liquid may enter at the top.

Needle-valve-controlled mixing equipment is attached to the vessel standard above the partition, and draws liquid from this point, above which there is a constant head of liquid. The pressures of the gas transmission line and the cylinder containing the odorizing liquid are equalized by means of a line connecting the header and the top of the vessel.

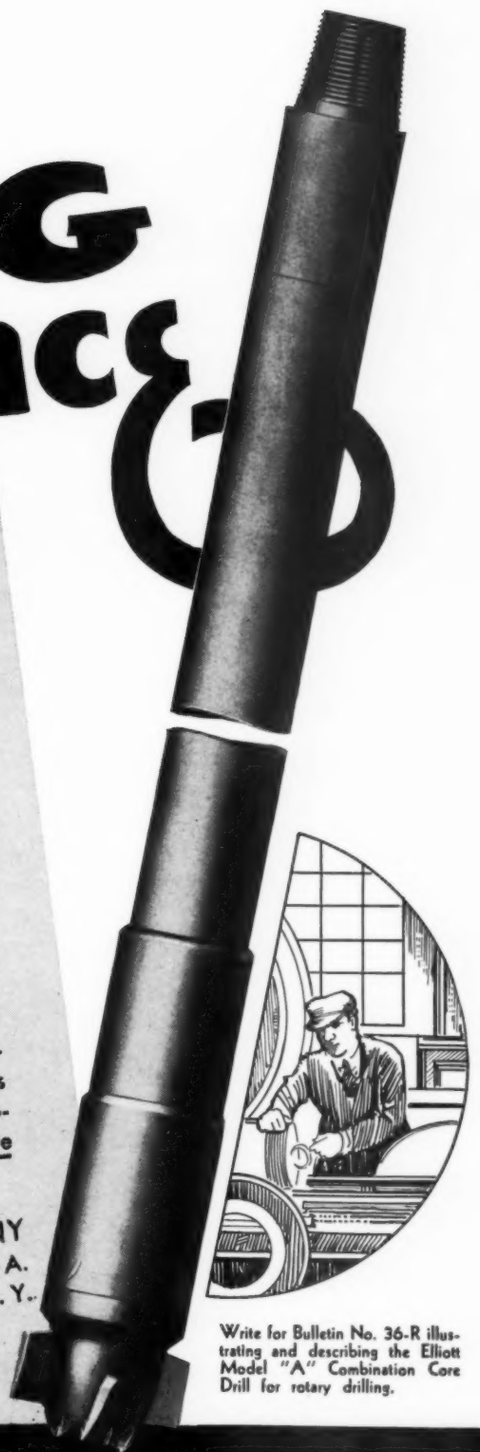
The point selected for the admission of the liquid into the gas is downstream from the last meter-run gate valve to prevent pocketing. The recording thermometer and pressure-recording instrument are placed near by, so that the line walker may save time when checking the unit, the temperature, and the line pressure. A similar unit, except that it is of larger capacity, has been placed on the residue line from The Texas Company gasoline plant in the same field.

MANUFACTURING EXPERIENCE *versus* CORING Experience

There is a vast difference between manufacturing for sale and manufacturing for use. Manufacture for sale, without the actual experience of usage back of it, too frequently is nothing more than a production problem. Manufacture for use on a highly competitive basis, however, entails many important characteristics from a strictly business standpoint. In core drilling service, for example, it involves correct design; simple, efficient operation; economical manufacture, operation and maintenance; and efficient, dependable performance. In such a coring service as Elliott has conducted for more than fifteen years, these are not merely desirable features of a tool—they are imperative to business life.

Elliott always has been essentially a coring service organization, conducting a coring service to oil companies on a strictly competitive basis; and intensively specializing on the development and perfection of coring equipment, coring practice, and coring results as a matter of necessity. The world's finest coring equipment is a natural, inevitable result of this manufacture for use procedure.

ELLIOTT CORE DRILLING COMPANY
4731 East 52nd Drive, Los Angeles, California, U. S. A.
Export Office: 420 Lexington Avenue, New York, N. Y.



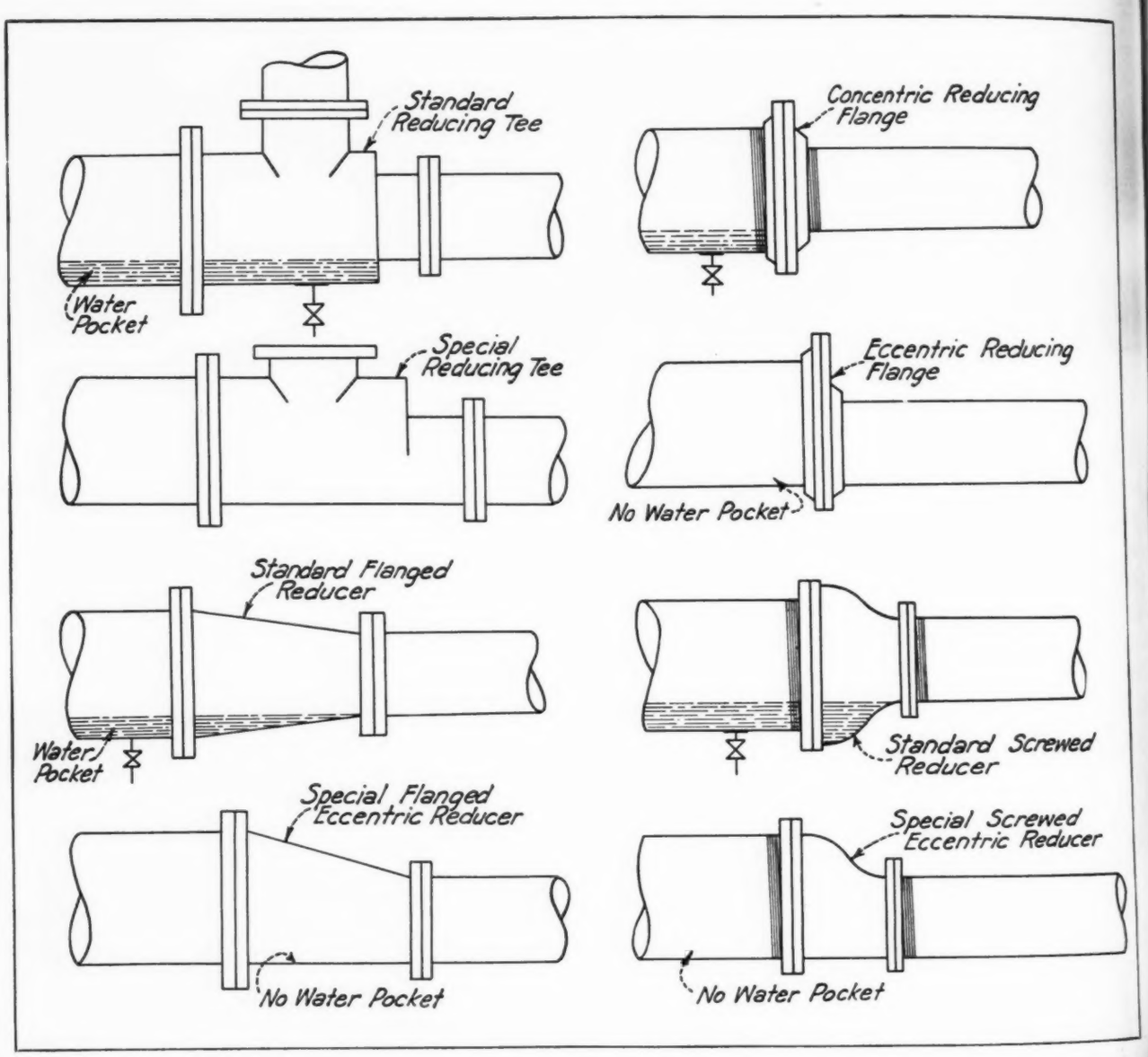
Write for Bulletin No. 36-R illustrating and describing the Elliott Model "A" Combination Core Drill for rotary drilling.

CORE

Eliminating Water Pockets in Piping Systems

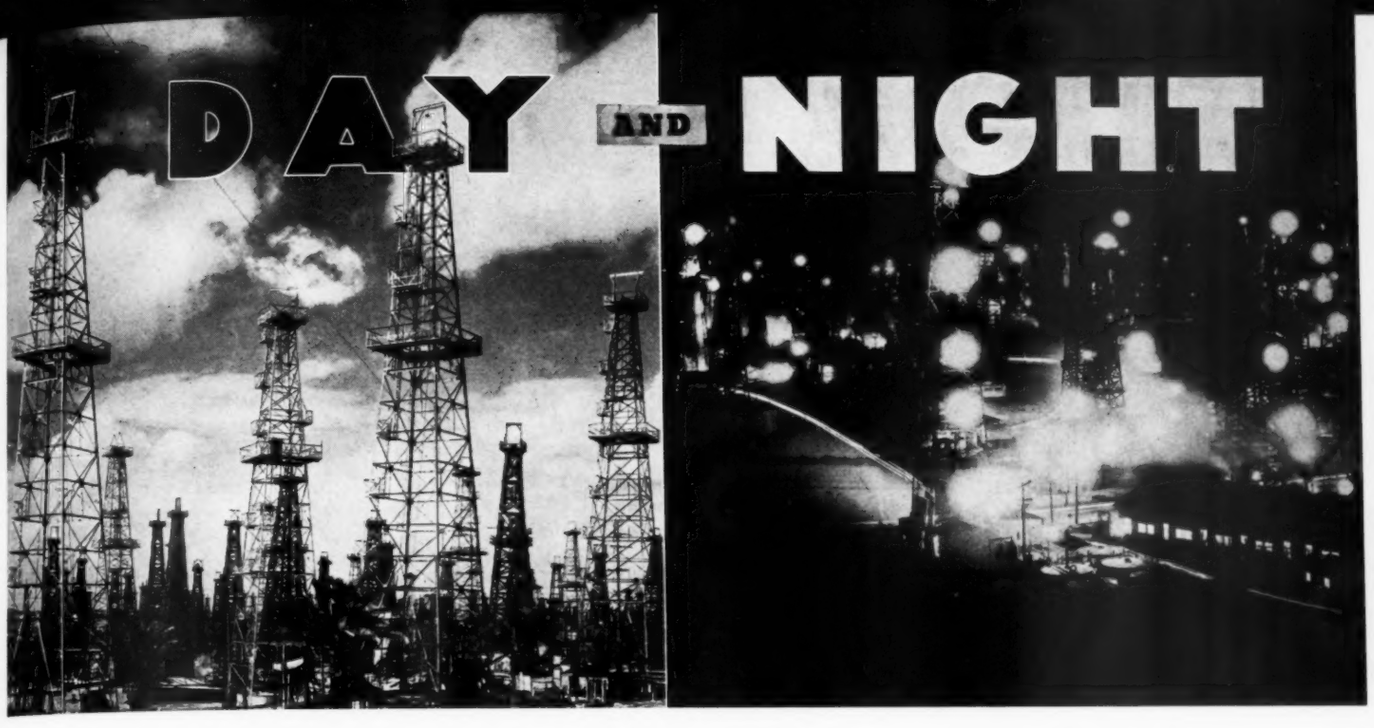
WATER pockets, or low places in a piping system where viscous liquids are likely to settle, are not desirable in any system of piping. In engine-cooling systems this may prove harmful by retarding the efficiency of the cooling medium. It is important in hot water and steam piping systems that the slope of all pipes should be in the direction of flow, and the fittings so installed as to obviate all water pockets and eliminate the necessity of frequent drainage. This can be done with little or no extra expense if correct fittings are used in the original construction. Quite often oil pipe lines have given considerable trouble due to the use of incorrect fittings.

The accompanying illustrations show the advantage of adapting ordinary fittings, or of employing special fittings that are obtainable commercially, in eliminating water pockets.



SERVICE

DAY AND NIGHT



BAASH-ROSS TOOL COMPANY

RENTAL

Get the tools you need *when you want them* from the big stocks carried at our shops in Texas, Oklahoma and California. You'll find a complete line of drilling and fishing tools, both rotary and cable tool. Whether your need is small or large, Baash-Ross doors are always open to serve you at a reasonable price—and you can depend on our tools to give you safe service. Ask for the Baash-Ross stock and price list of rental tools—keep it handy.

FIELD SERVICE

Day or night—in any kind of weather—a telephone call or wire from you will start an experienced Baash-Ross service man on his way to your well, bringing the RIGHT tools to do your job in the right way — safely and efficiently. We operate a line of complete sizes of Baash-Ross drill pipe and casing cutters, rotary jars, rotary releasing spears and sockets, casing perforators, safety joints, and many other fishing tools. Read the detailed, illustrated descriptions of these safe, modern tools in our 32-page section in the 1937 Composite Catalog — then call a Baash-Ross service man for your next job.

SALES

Quick service to your well of any of the tools in the Baash-Ross plant in Houston, or from stock at one of our other branches. Descriptions and ordering information are in the Baash-Ross section of your 1937 Composite Catalog.

BAASH-ROSS TOOL COMPANY

B-R

BAASH-ROSS TOOL COMPANY

BAASH-ROSS TOOL COMPANY

Telephone 3-4406
1559 S. E. 29th St.
OKLAHOMA CITY

Telephone Fairfax 9363
5300 Clinton Drive
HOUSTON

General Offices:
5512 Boyle Ave.
LOS ANGELES

Export Office:
30 Rockefeller Plaza
NEW YORK, N. Y., U. S. A.

Running Tour
WITH MEN IN THE INDUSTRY

JAMES A. MOFFETT, vice-president of the Standard Oil Company of California, and chairman of the board of the California Texas Oil Company, Ltd., is in the Far East inspecting properties of the latter company. He will return to his headquarters in New York City in July.

WILLIAM REINHARDT, who has been general manager of the Kettleman North Dome Association, has been made vice-president of the Union Pacific Railroad in charge of oil development. The Union Pacific has considerable development under way on its Wilmington, California, property. Reinhardt's headquarters are Los Angeles.

JAMES S. POSTGATE, Texon, Texas, assistant general manager of the Big Lake Oil Company, will retire May 1st and move to Santa Barbara, California.

R. C. THOMPSON, who has been a petroleum engineer with the Stanolind Oil and Gas Company, has been made assistant to E. A. Wahlstrom, chairman of the Goldsmith Field Engineering Committee.

J. A. LaFORTUNE, Tulsa, Oklahoma, vice-president and director of the Warren Petroleum Corporation, accompanied by Mrs. LaFortune, sailed recently on the Il de France for Paris, France. They will be gone about a month.

E. W. BECK has been named manager of purchases by the General Petroleum Company of California, Los Angeles, it is announced. **P. J. WHITELEY** is the new assistant manager.

R. D. MONTGOMERY has been made manager of production, and **FRANK A. MORGAN** head of the exploration division of the production department of the new Richfield Oil Corporation, Los Angeles, California, Charles S. Jones, president, has announced.

HAROLD P. GREENWALD recently was made supervising engineer of the Pittsburgh Experiment Station of the United States Bureau of Mines.

D. H. EMERSON, field foreman in Duval County for the Pan American Production Company, has been transferred to the Saxet field and is in charge of all the company's operations in Nueces County.

R. W. WAY, who has been foreman of the Humble Oil and Refining Company's gasoline plant at Conroe, Texas, has been placed in charge of the company's new plant at Tomball. **W. B. NICHOLSON** has been transferred from Rising Star, Texas, to be Way's assistant. At Conroe, **W. J. McDOUGAL** is the new plant foreman.

C. B. DONOVAN, JR., has joined the engineering staff of the Tulsa, Oklahoma, office of the Carter Oil Company. His duties consist mainly of supervising drilling equipment.

THOMAS K. WHITTINGTON, formerly production foreman at Duncan, Oklahoma, for the Carter Oil Company, has been moved to Kansas to supervise drilling and production operations in the South Otis Pool, Coralena Pool, and Walters Pool. Other supervisors who have been transferred from Oklahoma to Kansas are **E. M. DRAKE,** construction foreman, from South Burbank, and **HOBSON C. WEST,** sub-foreman, from Burbank.

SAM B. ARTERBURN, instrument man at Morris, Oklahoma, for the Oklahoma Pipe Line Company, has been transferred to foreign service at Caripito, Venezuela.

A. N. GRIFFITH, field engineer for the Cameron Iron Works, Inc., Houston, Texas, has resigned to accept a position with the production engineering department of the Shell Petroleum Corporation.

P. K. FROLICH, chief chemist for the Standard Oil Development Company, has been made head of that company's newly-formed chemical laboratories at Bayway, New Jersey.

C. A. BARRERE has been made plant manager of the Bradford Oil Refining Company, Bradford, Pennsylvania.

DR. FRANCIS C. TODD has been appointed assistant professor of petroleum and natural gas engineering at Pennsylvania State College to take the place of Dr. Gerald Hassler, resigned. Dr. Todd has been with the Reda Pump Company.

H. M. HERRON, president of the California Texas Oil Company, Ltd., subsidiary of the Bahrein Petroleum Company, Ltd., recently arrived in New York on the Normandie. He has spent considerable time recently in the Middle East.

SAM G. STOLTZ, chief production clerk of the Oklahoma division of the Empire Oil and Refining Company, with headquarters at Bartlesville, has been transferred to Hobbs, New Mexico, as chief production clerk for the West Texas-New Mexico division. He succeeds W. L. Hankins, who resigned to affiliate himself with the Hardin Truck Company. **E. D. BLACKBURN,** transferred from the Seminole area, where he has been engaged in production engineering duties, has taken over Stoltz's old post at Bartlesville.

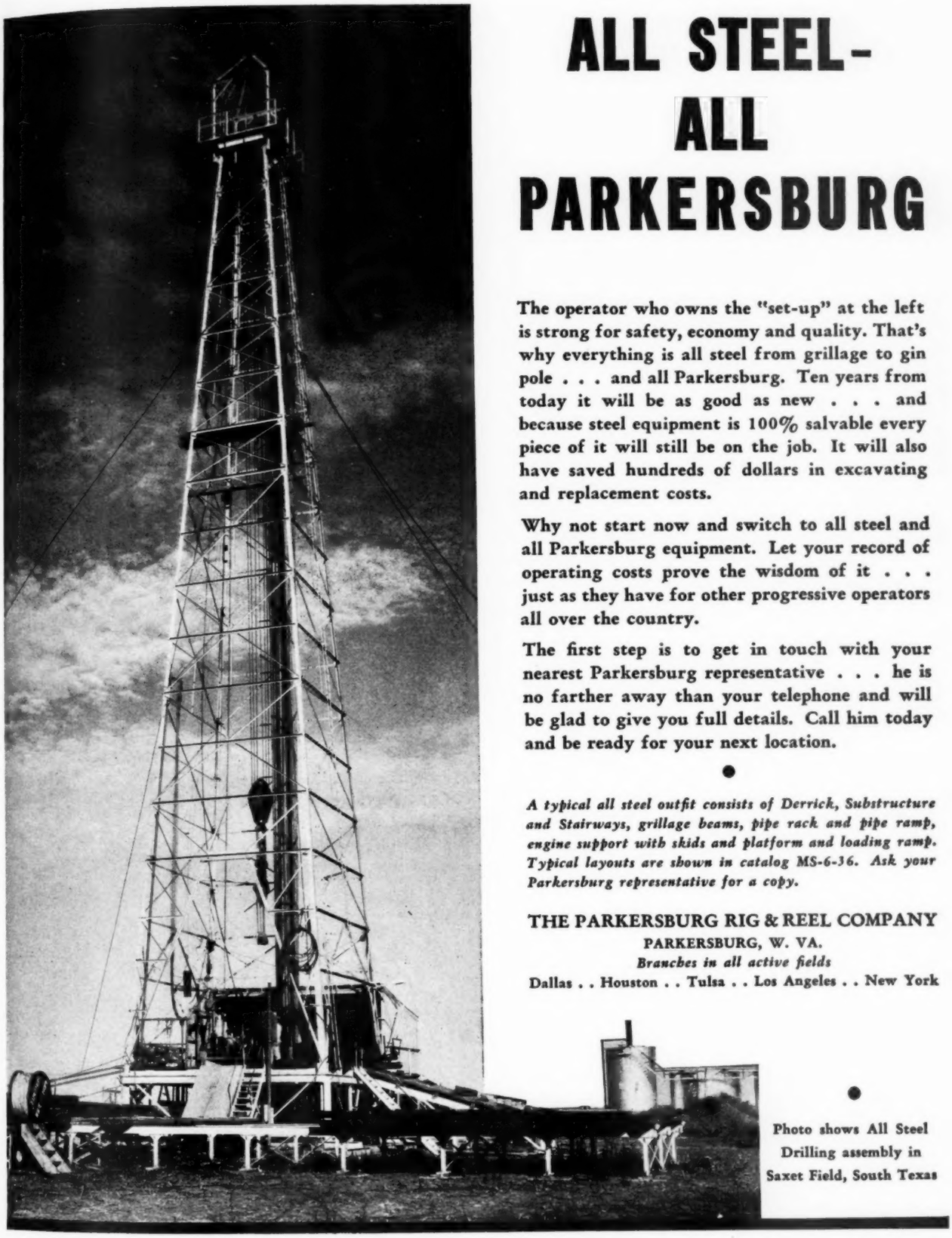
ROBERT M. BERNARDEAU has joined the engineering staff of the Stanolind Oil and Gas Company at Tulsa, Oklahoma.

ROBERT S. KING has resigned as president of the Pennzoil Company and will devote his time to extensive oil and ranch properties in Wyoming and the Mid-Continent.

DR. A. B. BRYAN, director of research in the Geophysical Division of the Carter Oil Company, Tulsa, Oklahoma, has been made head of the division, replacing Stuart Sheran, who resigned to enter private business. **G. E. WAGONER** becomes Bryan's assistant. He has been in charge of geophysical work for the Standard of Louisiana with headquarters at Shreveport.

HARVEY D. POWER of Oklahoma City, Oklahoma, has acquired the interests of Chas. F. Rayl of El Dorado, Kansas, in the White Deer Pipe Line Construction Company, and has succeeded him as president of the concern.

For Safety and Economy Specify



ALL STEEL- ALL PARKERSBURG

The operator who owns the "set-up" at the left is strong for safety, economy and quality. That's why everything is all steel from grillage to gin pole . . . and all Parkersburg. Ten years from today it will be as good as new . . . and because steel equipment is 100% salvable every piece of it will still be on the job. It will also have saved hundreds of dollars in excavating and replacement costs.

Why not start now and switch to all steel and all Parkersburg equipment. Let your record of operating costs prove the wisdom of it . . . just as they have for other progressive operators all over the country.

The first step is to get in touch with your nearest Parkersburg representative . . . he is no farther away than your telephone and will be glad to give you full details. Call him today and be ready for your next location.

●

A typical all steel outfit consists of Derrick, Substructure and Stairways, grillage beams, pipe rack and pipe ramp, engine support with skids and platform and loading ramp. Typical layouts are shown in catalog MS-6-36. Ask your Parkersburg representative for a copy.

THE PARKERSBURG RIG & REEL COMPANY
PARKERSBURG, W. VA.
Branches in all active fields
Dallas . . Houston . . Tulsa . . Los Angeles . . New York

●

Photo shows All Steel Drilling assembly in Saxet Field, South Texas

LAUGH WITH BARNEY

Edited by BARNEY HORRIGAN

What would be the proper thing to say if, in carving a duck, it should slip off the platter into your neighbor's lap?

Be very courteous. Say, "May I trouble you for that duck?"

—*Santa Fe Magazine.*

The mayor pressed a button on his desk and the office boy entered.

"Here," said his honor, "are a number of directions telling us how to run our city. See that every one is carried out."

And the office boy, gathering them all in a big waste basket, did so.

—*Christian Science Monitor.*

"The process of thinking draws the blood from the feet to the head," an educator informs us. This explains, perhaps, why, in so many cases, if you think twice about a proposition, you get cold feet.—*Atlanta Journal.*

"That's a skyscraper," announced the guide.

"Oh, my!" said the old lady, "I'd love to see it work."

—*Bridgeport Bulletin.*

"When I was a little child," the sergeant sweetly addressed his men at the end of an exhaustive hour of drill, "I had a set of wooden soldiers. There was a poor little boy in the neighborhood and after I had been to Sunday School one day and listened to a stirring talk on the beauties of charity, I was soft enough to give them to him. Then I wanted them back and cried, but my mother said:

" 'Don't cry, Bertie; some day you'll get your wooden soldiers back.'

"And, believe me, you lop-sided, mutton-headed, goofus-brained set of certified rolling pins, that day has come!"

"Sorry, madam, but licenses are issued only when your form is filled out properly."

"Why, I like your nerve, sir. We can get married no matter what I look like."

Wife: What's the idea of poking the broom in the baby's face this morning.

Hubby: I just wanted to get him used to kissing his grandfather.

Diplomat

A customer sat down at a table at a smart restaurant and tied his napkin around his neck. The manager, scandalized, called a boy and said to him, "Try to make him understand as tactfully as possible that that's not done."

Boy (seriously to customer): Shave or haircut, sir?

One of the men spoke: "I dug this hole where I was told to and began to put the dirt back like I was supposed to. But all the dirt won't go back in. What'll I do?"

For a long while the supervisor pondered the problem. Then: "I have it. There's only one thing to do. You'll have to dig the hole deeper."

What's worse than raining cats and dogs?

Hailing taxis.

—*Lord Jeff.*

"I'se just been bit by a dog and I'se worried. I hear whenever a dog bites you, whatever the dog has, you get."

"Boy, then you have a right to worry."

"Why?"

"That dog just had eleven pups."

—*Puppet.*

Exact

Young Brown got a job in a shipyard. The first morning the foreman gave him a two-foot rule and told him to go and measure a large steel plate. Brown returned in twenty minutes.

"Well," inquired the foreman, "what's the size?"

The youth displayed a satified grin.

"It's just the length of this rule," he said, "and two thumbs over, with this brick, and the breadth of my hand, and my arm from here to there, bar the finger nails."

A fat lady stepped on the scales, not knowing it was out of order, and put in her penny. The needle went up to 75 pounds and stopped.

An inebriated gentleman who was watching intently, staggered.

"My God!" he said. "She's hollow."

Blow: There I was, cast away on a desert island with a lovely woman.

Glow: What did you do for food?

Blow: Darned if I can remember.

"Give me a quart of red oil," she said to the service station attendant.

"A q-quart of r-r-r-red oil?" he stuttered.

"Certainly," she said. "My tail-light has gone out."

Kidnapping

First Young Hubby: We had a sensational case of kidnapping in our house lately.

Second: Really! How did it happen?

First Young Hubby: The baby slept the whole night.

Retort Courteous

For two hours he had been the pest of the party. His imitations were terrible, ranging anywhere from George Arliss to a humming-bird. In the far corner had been sitting the man with the screwed-up face.

"What would you like to see me imitate now?"

The man moved. He spoke. "How about a ground hog, that's seen its shadow?"—*Pure Oil News.*

"You ought to cut my hair cheaper, there's so little of it."

"Oh, no. In your case we don't charge for cutting the hair, we charge for having to search for it."

Holmes: Ah, Watson, I see you have on your winter underwear.

Marvelous, Holmes, marvelous. How did you ever deduce that?

Well, you've forgotten to put on your trousers.

At the Zoo

"That's a new one on me," said the monkey as he scratched his back.

A city girl visiting her uncle on the farm was watching a cow chewing her cud.

"Pretty fine cow, that," said her uncle as he passed by.

Yes," said the girl, "but doesn't it cost a lot to keep her in chewing gum?"

Once in a Lifetime

"What induced you to strike your wife?"

"Well, your Wuship, she 'ad 'er back to me, the frying-pan was handy, and the back door was open, so I thought I'd take me chance."

Here are the Correct Answers to the

BAKER I. Q. CONTEST

Congratulations to the winners! Prizes are being forwarded, and if yours has not been received it will reach you in a day or so. To every contestant we are sending a gift to evidence our appreciation of your interest . . . watch for yours!

QUESTION NO. 14

Most Often Incorrectly Answered

We will admit that No. 14 was worded to make you think —or even to refer to a catalog —but it was not "tricky."

The Question was . . .

14. If you want to retain cement "tailings" inside the casing, what one of these Baker Tools would you use?
    - . . Baker Cement Retainer
    - . . Baker Cement Float Collar
    - . . Bakwik Drill Pipe Float
    - . . Baker Cleanout Bailer

. . and the tool to use is a Baker Cement Float Collar, as shown in the illustration, and *not* a Baker Cement Retainer.

By using a Baker Cement Guide Shoe on the end of casing strings of average length, and a Baker Cement Float Shoe on longer strings, you can be sure of proper guiding.

Modern practice has indicated that it is desirable to "retain cement tailings inside the casing" and the Baker Cement Float Collar provides the ideal means.

Note from the illustration how the cementing plug is stopped by the Float Collar, and soft cement (tailings below the specified consistency) are retained inside the casing, and only good cement goes outside the shoe and behind the casing.

Complete descriptions can be found on Page 198 of the 1937 Baker Catalog or the Composite Catalog.

FOR DETAILED QUESTIONS SEE THE PETROLEUM ENGINEER

Dated March, 1937

(Page numbers refer to both the Baker Catalog and/or the Composite Catalog for 1937)

1. **Oil Well Supply Company is celebrating its 75th Anniversary in 1937.**
2. **The valve in a "Bakwik" Drill Pipe Float is held in place by the tool joint pin; see page 234.**
3. **Baker Kelly Straighteners operate by hydraulic pressure; see page 237.**
4. **If drill pipe has been twisted off in a cave, you would find either a Baker Rotary Wall Hook or a Baker Yungling Spiral Guide an extremely useful tool; see pages 236 and 244.**
5. **The valve assembly in a Baker Cement Float Shoe is made of bakelite; see page 191.**
6. **Three important uses for the Baker Model F Cement Retainer are listed on page 207.**
7. **Cement can be directed upward around the shoe and casing by using a Baker Cement Whirler Float Shoe; see page 195.**
8. **Cores taken from extremely hard formations with a Baker Cable Tool Core Barrel usually are recovered in the form of biscuits; see page 230.**
9. **The purpose of the rubber ring in a Baker Cement Float Collar is to provide a positive leak-proof seal against low or high back-pressure; see page 189.**
10. **If plastered mud prevents a well from coming in easily, you need a Baker Rotary Wall Scraper; see page 216.**
11. **One of the many successful uses of a Baker Cement Retainer is to perform squeeze jobs; see page 207.**
12. **Cores are easily taken from the side wall of an open hole by using a Baker Rotary Wall Sampler; see page 222.**
13. **To enlarge a drilled hole and leave an absolutely flat bottom (for intentional deflection of hole) the Baker Rotary Bottom Hole Scraper is used; see page 221.**
14. **If you want to retain cement "tailings" inside the casing, you would use a Baker Cement Float Collar; see page 198.**
15. **The material drilled out of a Baker Cement Float Shoe consists of Baker Concrete (or cement) used for the plug; Bakelite used for the Valve Assembly; and a negligible amount of rubber in the ring which insures a leak-proof seal against back-pressure; see page 192.**
16. **The maximum reaming size of a No. 3-A Baker Wall Scraper is 11 inches; see page 218.**
17. **The valve ball in a Baker Cement Whirler Float Shoe is made of Bakelite; see page 189.**
18. **The Canvas Basket Assembly on a Baker Whirler Collar serves to protect lower oil sands from cement; see page 199.**
19. **Baker uses concrete in all equipment for guiding, floating and cementing casing, because it is easy to drill up and circulate out of the hole; see page 192.**
20. **To determine the presence in "returns" of material drilled out of the shoe or collar, Baker pioneered and introduced the use of red concrete for the concrete plug in Baker Cement Equipment for Guiding, Floating and Cementing strings of casing; see page 190.**

Watch for the announcement in the near future of a Bigger and Better Baker I. Q. Contest. The information you will need to win is contained in the 1937 Composite Catalog and in the Baker Catalog, which every oil man should have in his files—write today for your copy.

BAKER OIL TOOLS, INC.

Telephone LAfayette 0153 – HUNTINGTON PARK, CALIFORNIA – 2959 E. Slauson Ave.
Telephone WAyside 2108 – HOUSTON PLANT AND OFFICE – 6023 Navigation Blvd.

MID-CONTINENT OFFICE AND WAREHOUSE:
Telephone 2-8083 – Tulsa, Oklahoma – 312 East Fourth Street

WEST TEXAS BRANCH OFFICE
Odessa, Texas – Telephone 217

EXPORT SALES OFFICE
Rm. 1914 – 19 Rector St., New York City
Tel. Digby 4-5515

ROCKY MOUNTAIN HEADQUARTERS
Tel. 2230-Casper, Wyoming – Box 1464

QUESTION NO. 13

Another one that caused trouble

Many a contestant failed to win a Twin-deck Set of Cards because of unlucky No. 13 —but the answer is easily found on Page 221 of the 1937 Composite Catalog, or the Baker Catalog.

Here's the Question

13. What Baker Oil Tool is used to cut formation as shown in this illustration?

. . and the Baker Oil Tool to be used is a Baker Rotary Hydraulic Expansion Bottom Hole Scraper which is operated very similar to the Baker Wall Scraper, the only difference being that it will underream right to the bottom of a hole, leaving an absolutely flat bottom.

The most important use is to provide a large diameter hole with a *flat bottom* when a deflecting tool is employed —as shown in the illustration.

Many operators are also using the Baker Rotary Bottom Hole Scraper to enlarge the hole before running casing, and thus give space for placing a greater body of cement around the shoe and casing.

This tool is also proving popular for enlarging the hole right down to the top of a fish, to provide ample room for operating and a better chance to get over the fish.

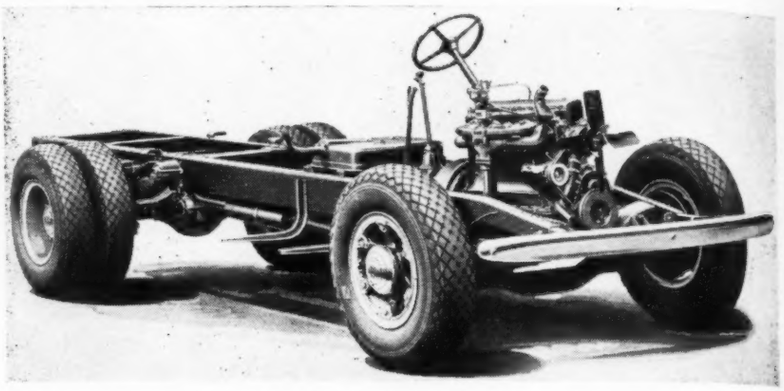
On Page 221 will be found complete details.

MACHINERY and EQUIPMENT

International Harvester's New Full Truck D Line

OF special interest to truck users is the recent announcement that International Harvester Company, Chicago, Illinois, has an entirely new line of motor trucks ranging in capacity from light delivery units to the largest six-wheeler. These new models include conventional four-wheel units, six-wheelers with both dual-drive and trailing axles, and cab-over-engine types. The complete International line consists of 26 models in 77 wheelbases with gross vehicle weights ranging from 4,400 to 62,000 pounds.

These new Internationals provide universally standardized (S.A.E.) cab-to-rear-axle dimensions so vitally necessary to body interchangeability, and they also permit mounting of standard length bodies of stock sizes. Front axles are set back, and this, together with the relocation of rear axles and cabs, contributes to greatly improved load distribution, not only of body and payload but of gross weight as well.



The International DR-60 (double-reduction drive) chassis shown here is rated at four to five tons. The carrying capacity (cab, body, equipment, and payload) is 12,500 pounds

Wheelbases, in conjunction with correct cab-to-rear-axle dimensions, are available to accommodate all lengths of bodies, with the ideal conditions resulting from the use of bodies in even foot lengths.

Many decided improvements and new features of design and construction have been incorporated in the engines of the International models.

"Caterpillar" Tractors with Trackson Pipe Layers

In laying 60 miles of pipe line from Leech, Kentucky, to Charleston, West Virginia, over mountains the "Caterpillar" 35 and LaPlant-Choate roadbuilder rough out right-of-way, clearing a path for the ditcher

"CATERPILLAR" RD6 and R5 tractors are now available equipped with Trackson Pipe Layers, according to announcement made by Caterpillar Tractor Company, Peoria, Illinois. Three additional models of "Caterpillar" track-type tractors also will be available with Trackson Pipe Layers in the near future.

The machines are unusually rugged, it is claimed, yet fast and responsive to every pipe handling need. They lift, lower, carry, and bend pipe, and serve as efficient side cranes for other heavy-duty lifting service.

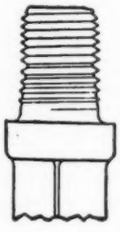
The entire structure can be removed easily and quickly when the tractor is to be used extensively for other work. In operation the load and boom lines are raised and lowered under power by means of worm-driven winches. A selection of three speeds is provided by the special Trackson transmission and cross-drive mechanism. A single lever controls the direction of rotation of the drums, so that either can be raised or lowered separately or together, as desired.

Power for driving the pipe layer is from the "Caterpillar" rear power take-off through a ball-bearing-mounted friction clutch.

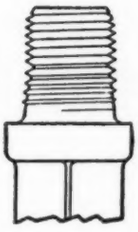
"Prayer Alone is Not Enough"!

Strength in sucker rods is not attained by prayer and fasting. It only comes as a result of years of study and experience on the part of the manufacturer and operator. Because of this experience reflecting decades of contact with the oil industry, Axelson is today offering three grades of sucker rods. The installation of whichever one of these rods is best suited to meet individual well pumping conditions is not guaranteed by Axelson to eliminate all pumping trouble. It is, however, the honest belief of Axelson engineers and Axelson field men that these rods will REDUCE BREAKAGE, INCREASE ROD LIFE and DECREASE PUMPING COSTS.

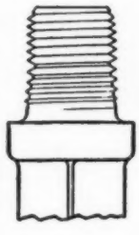
From any Axelson representative, you may obtain the full story of Axelson's manufacturing operations and field laboratory tests which make Axelson Rods today's best sucker rod buy.



Axelson No. 60 Sucker Rods are made from exceptionally high-grade carbon steel under strict alloy practice. They are fully tempered from end to end, assuring consistent physical properties. The ductility and impact resistant properties of these rods is such as to indicate their practical use for all average to heavy pumping conditions.



Axelson No. 59 Sucker Rods are made of special alloyed steel that materially aids their resistance to corrosion and are fully normalized and tempered from end to end. They present excellent physical properties combining increased ductility and impact resistance with high yield and tensile strengths. These rods are desirable for pumping wells where extra heavy loads are encountered and where irregularities in pumping movements are unavoidable.



Axelson No. 69 Sucker Rods are made from a high alloy special nickel molybdenum steel produced in electric furnaces. These rods are especially resistant to corrosion, are fully normalized and tempered from end to end. They offer excellent yield and tensile strengths with great ductility and impact resistant properties.

Axelson Manufacturing Company, P. O. Box 710, Vernon Station, Los Angeles • St. Louis • 50 Church Street, New York • Tulsa
Mid-Continent and Eastern Distributor: Frick-Reid Supply Corp. • *Rocky Mountain Distributor:* Great Northern Tool & Supply Co.

DEEP WELL PLUNGER PUMPS **AXELSON** SUCKER RODS

Bridgeport Steel Tool Box

THE Bridgeport Steel Tool Box, manufactured by the Bridgeport Machine Company, Wichita, Kansas, is designed to withstand the rough handling to which it may be subjected in the field; for convenience and safety; and for long, economical service.

It is constructed of heavy gauge steel plate, substantially braced in the center, and reinforced throughout with heavy angle iron. The top is heavily reinforced at front and ends with box-type angle iron to prevent denting and distortion should heavy tools be allowed to strike it. The shelf or supply bin, which is 12 in. wide and 4 in. deep, is made of heavy gauge plate and extends the full length of the box, adding strength and rigidity.

The lid, which is attached to the box by three heavy, electric-welded, tamper-proof hinges, is flanged down around the edges to keep out water and dirt and to make it more rigid. A heavy stop chain at each end holds the lid in place when open. The two lifting handles add to the convenience of opening and closing the lid. Equipped with vault-type locking device, it is burglar-proof and fool-proof.

The box is electric welded to 4½-in. pipe skids, the front and rear cross members of which extend past the main base for convenience in attaching chain or winch line when loading, unloading, or skidding the box from place to place.

Size: 3-ft. wide; 3-ft. high; 8-ft. long. Weight: 1316 lb.

Raines Thief Hatch

THE Raines Thief Hatch was introduced to production men about 18 months ago by John Fryer, 1436 South Trenton Avenue, Tulsa, Oklahome, as an innovation in controlling tank vapors.

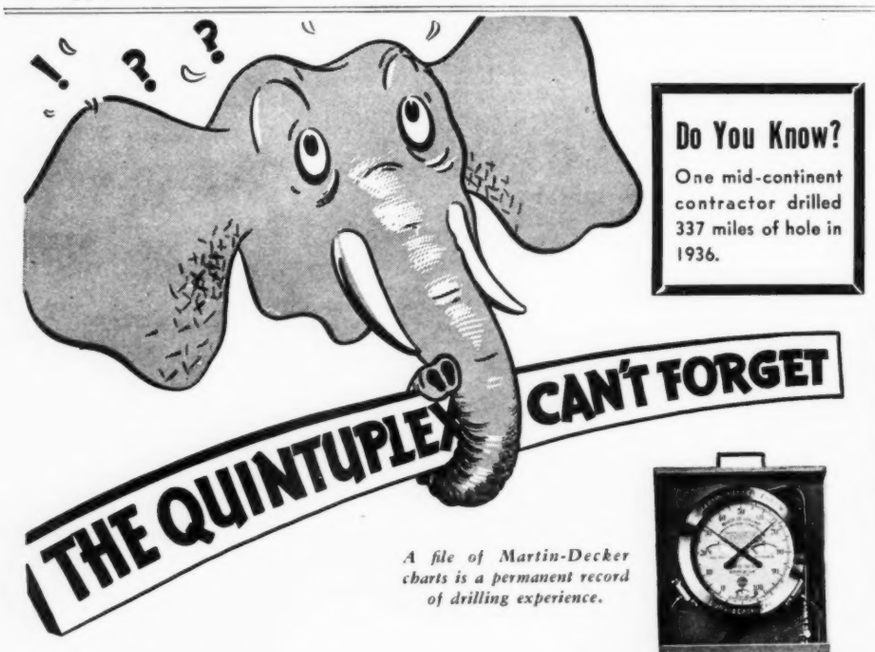
Constructed of cast aluminum it precludes the danger of spark in closing the cover and is non-corrosive

throughout, its manufacturer states. The vacuum and pressure valves and seats are machined and lapped on the original casting, eliminating the use of rubber or other materials subject to deterioration for seats.

The pressure valve is carried by the cover and operates independently thereof as it is controlled by a manometer-tested, oil-tempered spring housed in a moisture- and vapor-tight bonnet. The vacuum valve operates on a stem in guide under the desired vacuum and closes by gravity drop.

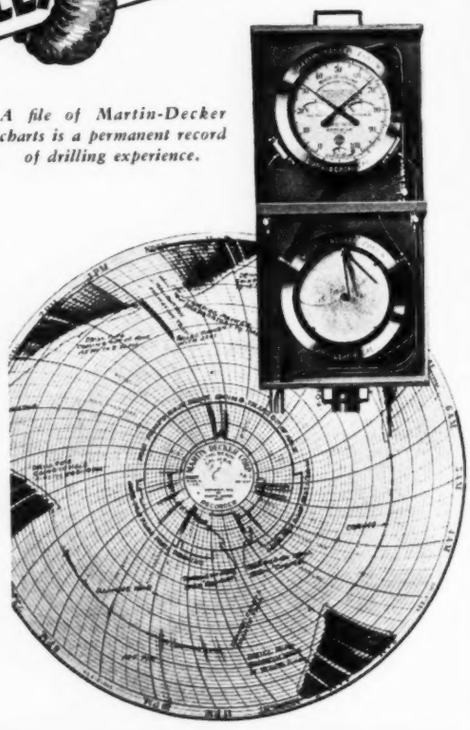
When the hatch is open the cover carrying the complete valve mechanism leaves a full 8-in. opening for running the thief.

The hatch is manufactured either straight or pitch base to fit the majority of tank manufacturer's bolt circles; to control 2-, 6-, 10-, and 16-oz. pressure with ½-oz. or 4-oz. vacuum and is adaptable for use on wood water-seal deck, bolted or welded tanks.



Do You Know?
One mid-continent contractor drilled 337 miles of hole in 1936.

A file of Martin-Decker charts is a permanent record of drilling experience.

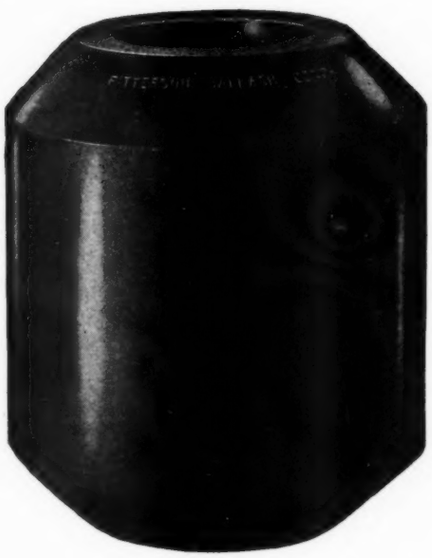


A Thousand and One things to remember — mud pressure fluctuations — torque changes — weight variations — how long in the hole—how long on top . . . even an elephant couldn't remember all the things that happen around a rig in one day, but Quintuplex CAN'T forget! It keeps a constant check on the weight, torque, and mud pressure, writing down changes the instant they occur.

Furthermore, Quintuplex centralizes the five important drilling gauges — weight indicator, super-sensitive weight indicator, torque, mud pressure, and rotary table r.p.m.—right under the driller's eyes where they're easy to watch and easy to read, yet not in the way.

THE WEIGHT INDICATOR
MARTIN-DECKER CORPORATION
LONG BEACH CALIFORNIA
San Joaquin Valley: A. F. McQUISTON, Bakersfield, California
Mid-Continent Distributor: REED ROLLER BIT COMPANY, Houston, Texas

GIVE YOUR WELL PROTECTION AGAINST CUTTING ACTION OF WELDED TOOL JOINTS



Use of welded tool joints has become standardized practice in many drilling operations. The welded metal ring is file-hard and projects beyond the normal tool joint diameter. Unless protected with casing protectors, these rings set up a milling action, causing even more casing wear than tool joints not welded.

If welded tool joints are used *be sure* that genuine Patterson-Ballagh Casing Protectors are installed. This safety measure has been adopted by hundreds of operators who have standardized on these tough rings of seamless resilient rubber.

CUT DOWN ON FISHING JOBS

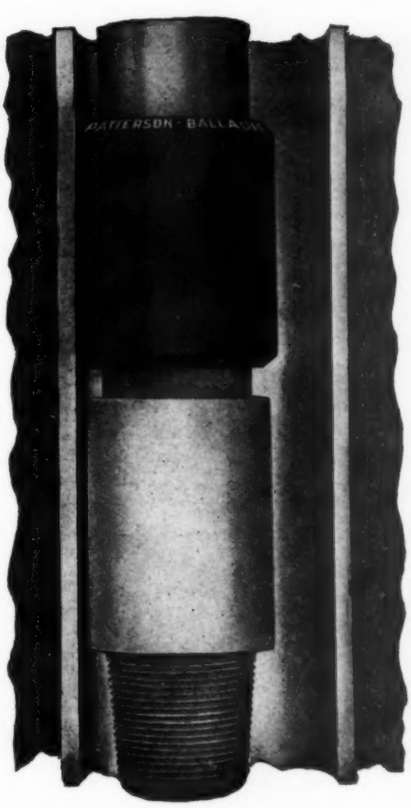
Loss of production in a well caused by even a small fishing job invariably costs more than the price of a string of Patterson-Ballagh Casing Protectors. Perhaps the last fishing job you experienced would not have happened had these resilient cushions of live rubber been used.

You will experience fewer twist-offs, fewer collapsed casing jobs and may eliminate the necessity of re-cementing before the oil string is set.

Thousands of strings of Patterson-Ballagh Protectors have been successfully used. They are standard equipment on practically every deep drilling rotary well. Countless wells could not have been drilled to great depths without the aid of these protectors.

Patterson-Ballagh Protectors are freshly stocked in the principal drilling fields in every required size. Users of these protectors are furnished with the patented Patterson-Ballagh expander tool which permits easy installation.

Literature upon request



PATTERSON-BALLAGH PROTECTORS

PATTERSON-BALLAGH CORPORATION

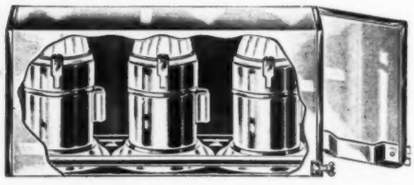
Plant and General Offices: 1900 East 65th Street, Los Angeles, Calif., U. S. A.

New York Office: 39 Cortlandt St. Oklahoma Office: Oklahoma City, 1704 N.W. 17th St. Texas Office: Houston, 515 M & M Building

Louisiana Office: Box 23, Oil City, La.

Electric Flare

A NEW approved electric flare, manufactured by Economy Electric Lantern Company, Inc., Chicago, Illinois, has the long life of service



(60 to 80 hours) needed by truck and bus fleets, the makers state. It is visible at a half mile under normal conditions.

To assist in keeping the flares from rattling or breaking, the manufacturer supplies a metal container, providing protection against such annoyances and dangers, with the purchase of each set of three.

Flashing types also are available.

I. C. C. Safety Regulations issued December, 1936, make it a violation of law for any truck carrying compressed inflammable gases, or inflammable liquids in bulk, to use any flares other than electric. This flare complies with the I. C. C. regulation, and also has received the endorsement of the National Board of Underwriters, according to the manufacturer.

Coffing's Pipe Line Hoist

A NEW Coffing model ratchet gravity-lowering pipe line hoist is being manufactured by the Coffing Hoist Company, Danville, Illinnois. The new model is known as the R-G-L.

This hoist is a spur-gear hoist with ratchet lift and gravity lowering, the lowering speed being controlled by governors. It is convertible into 2-, 4-, and 6-ton capacities by using single, double, and triple chain.

Special heat-treated Diamond chain is used to meet the terrific strain imposed by overloading. The chain is tested to lift 12,000 lb. per single strand.

Another interesting feature is the safety valve handle that will bend under maximum overload before the hook will straighten out or the chain break.

The hoist weighs 56 pounds. It is especially adapted for raising and lowering pipe, and it may be used for many other uses around the oil fields, such as bending pipe, tightening rod lines, and loading and unloading trucks.

The hoist has been successful in field tryouts for the past year, the manufacturers state.

Complete information may be obtained by writing the Coffing Hoist Company.

ONE YEAR OLD!

Completing its initial year the United Supply and Manufacturing Company, through its management and personnel, appreciates the opportunity of expressing to its many friends and patrons sincere gratitude and deep appreciation for the consideration accorded it. Without such confidence progress and growth would have been impossible.

We, too, take pleasure in announcing an expansion in our operation; the addition of three new stores with others to follow. Our stocks have been augmented and increased and we are fittingly prepared to competently serve the oil and gas industries. To those unfamiliar with our facilities may we not anticipate the pleasure of serving you?

Competent, Courteous, Efficient Service

STORES:

Chase, Kansas
Hutchinson, Kansas
Oklahoma City, Okla.
Stonewall, Okla.
Eunice, New Mexico
Houston, Texas
Odessa, Texas

UNITED SUPPLY & MANUFACTURING COMPANY

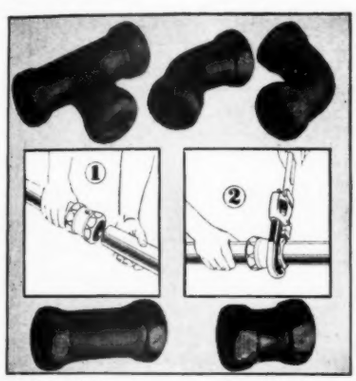
TULSA, OKLAHOMA

H. B. GUTELIUS C. J. HALLORAN F. P. THIEMAN

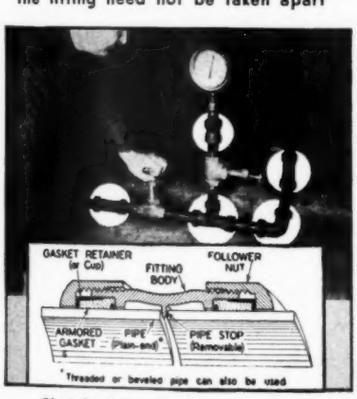
Pipe Connections Easily Made With Dresser Fitting

FOR making pipe connections rapidly and with minimum effort the S. R. Dresser Manufacturing Company, 697 Fisher Avenue, Bradford, Pennsylvania, has manufactured and placed on the market the Style 65 Compression Fitting, a simple, novel, and self-contained pipe joint. A fitting can be completely installed in a few seconds time with but one tool, a wrench. This latter advantage, the makers point out, is especially helpful in cramped quarters, and in assembling or making changes in intricate and inflexible piping systems.

After inserting the plain-end pipe into the fitting (which comes completely assembled), it is only necessary to tighten two threaded octagonal follower nuts with a few quick turns of



Style 65 Fittings come assembled ready for use. Sketch shows simplicity of installation. To install: (1) simply insert the pipe ends into the fitting, and (2) tighten the followers. Note: Followers may be loosened slightly to permit easier entry of the pipe but the fitting need not be taken apart



Sketch shows working principle

the wrench. As this is done, resilient "armored" gaskets at each end of the fitting are compressed tightly around the pipe, forming a positive seal. The resulting joint, Dresser engineers point out, not only is permanently tight but absorbs normal vibration, expansion, and contraction movement, and permits deflections of the pipe in the joint. If the pipe already is threaded, it also can be joined in the same manner.

The complete line of Style 65 Fittings includes: standard and extra-long couplings, ells (both 45-deg. and 90-deg.), and tees, all supplied in standard steel pipe sizes from ½-in. I.D. to 2-in. I.D., inclusive, black or galvanized.

These fittings are recommended by the manufacturer for simplifying joint-making and repair work on both inside and outside piping, for oil, gas, water, air, or other industrial lines. The basic principle is essentially the same as that used in other styles of the well-known Dresser Coupling.

All Style 65 Compression Fittings conform to specifications for 150-lb. malleable fittings, and when properly installed may be safely recommended for working pressures up to and including 150 lb. per sq. in., the manufacturers state.

A pamphlet describing in detail Style 65 Compression Fittings has been issued by the S. R. Dresser Manufacturing Company. Copies will be sent free upon request.

Armored like a Battleship
GRIZZLY POWERFLEX
POWERFUL
FLEXIBLE
There is as much difference between Grizzly Powerflex and the average rotary hose as there is between today's super-dreadnaughts and the wooden fighting ships of yesterday. Among other exclusive features, Grizzly Powerflex is armored like a modern battleship. It is this effective armor that protects Grizzly Powerflex against blowouts, even under the highest pressures.
GRIZZLY POWERFLEX ROTARY HOSE
E. M. SMITH COMPANY
600-650 South Clarence Street, Los Angeles, California, U.S.A.
Export Office: Continental Emsco Co., 30 Rockefeller Plaza, New York City
DISTRIBUTED BY LEADING SUPPLY COMPANIES

Superior Sand Pump With Improved Top

THE Oil Well Supply Company, Dallas, Texas, has made an improvement in the design of its Superior Sand Pump whereby only one line is required for both sand pump and cleaning-out tools, and it is not necessary to cut it when changing from one to the other.

This new feature is of utmost importance where only one drum is available. Heretofore it was necessary to cut the line and babbitt the new end in the rope socket or sand pump plunger every time a changeover was made. Now only a few minutes are needed for the change, completed without cutting or otherwise damaging the line.

Operators using tractors for cleaning-out work find this new advantage of special convenience, the manufacturers state, as it is common practice at the end of the day to detach the tools or sand pump from the wire line to permit removal of the tractor from the location.

In order to provide the Superior Sand Pump with its important new features, it was necessary to develop the "improved top" and make certain changes in related parts.

Buckeye Clipper Line

THE Buckeye Traction Ditcher Company, of Findlay, Ohio, has placed on the market a line of ¼-, ⅝-, and ¾-yard excavators, with shovel, crane, dragline, clamshell, and trench hoe attachments. The new machines are known as Buckeye Clippers, Models 50, 60, and 70.

Modern engineering and materials—100 percent electric alloy steels, antifriction bearings, heat-treated shaft-

ing, etc., used throughout—have produced a machine stripped of all excess weight and designed for modern, fast, efficient, safe operation, the manufacturers state.

Characteristic of modern engineering found throughout the machine is the use of a tubular dipper stick, combining strength and flexibility with moderate weight. The streamlined cab of the new Clipper reflects this modern engineering.

One of the departures in design is the perfected system of control by *metered vacuum*. All operations are controlled from a simple control panel, where small levers move easily at the touch of the operator's fingers.

Among other advantages of this vacuum-type control system is complete freedom from trouble due to extremes of temperature, small leaks, or water in the lines, it is stated. Automatic vacuum-controlled brakes add considerable to the efficiency of operation.

When "Teddy" Roosevelt was president and 'Frisco had its famous fire...

...that's the year we started in business

A heap of things have happened since Mr. H. C. Brewster started this business of ours with a little machine shop more'n thirty years ago. Battles, ballots, booze, bathing beauties and boom times have repeated themselves in the headlines since we first opened our doors.

Ever since that humble beginnin' we've enjoyed a healthy growth, and that little shop is now eight branch stores that cover every major oil and gas field in the Gulf Coast and Mid-Continent Area.

And at every one of these stores you'll find a man that was born an' raised in the shadow of a derrick . . a man that knows this drilling business from the bit up . . and what's more, you'll like him!

Say . . why don't you call us today?

The BREWSTER CO. Inc.

PHONE 3181 SHREVEPORT, LA.

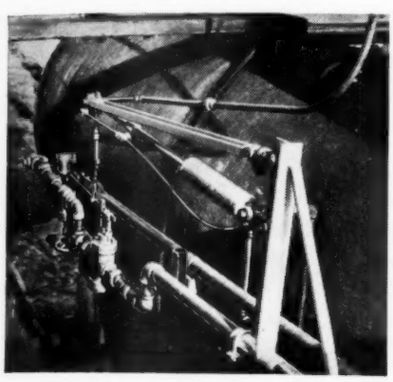
Houston, Texas Longview, Texas Corpus Christi, Texas Houma, La.
Rodessa, La. New Iberia, La. Lake Charles, La. Shreveport, La.

Export Office: Acme Well Supply Co., 136 Liberty Street, New York City

Improved Boiler Feed-Water Level Control

A NEW feed-water lever control with extreme sensitivity to maintain levels within ½ in. has been developed. It is made in one size to meet all boiler needs and will operate any valve up to 12 in., its manufacturers state.

It is called the Campbell-Cantilever Boiler Feed-Water Level Controller. It is installed on the side of the boiler, easily accessible. The frame is set so that the water level mark is at the same level as the desired water level in the column. When the water level drops in the gauge glass, water runs down an inclined tube exposing it to the high temperature of the steam at boiler pressure. This instantly causes rapid expansion, which is multiplied eight times due to triangular construc-

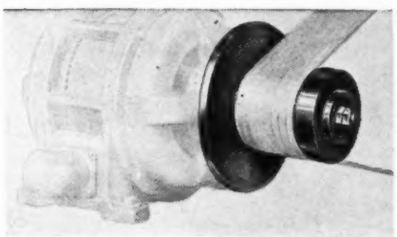


tion. This causes the end casting to move upward, opening the valve an amount equal to eight times the extent of the expansion. If the water rises in the gauge, the cooling action of the cool water rising in the tube causes contraction that lowers the end casting and closes the valve by an amount equal to eight times the contraction. The action is automatic and requires no manual operation or attention from the boilerman.

There are many applications for the controller other than in boiler feed regulation. Write J. A. Campbell Company, Box 851, Long Beach, California.

Dickson Automatic Clutch

THE Dickson automatic clutch for reducing motor starting overloads consists of three principal parts: (1) a drive plate that is keyed to the drive shaft; (2) a movable plate, upon the hub of which is keyed a pulley, sheave, or sprocket, the entire assembly being mounted on a quill; and (3) floating on the shaft, an actuating unit equipped with a time-lag adjusting mechanism and containing centrifugal weights that operate the movable clutch plate as the actuating unit comes up to speed. It will operate equally well on a reversing motor. A



simple adjustment regulates the time-lag period.

The adjustable time-lag permits the motor to attain full speed before the load is applied. It applies the load gradually over any reasonable period of time.

It is made in sizes ranging from 1/20th hp. to 350 hp. and for speeds from 600 r.p.m. to 3600 r.p.m. The time-lag interval is adjustable, downward from the maximum, the maximum may be as much as ten minutes. Under special conditions it can be installed on the high-speed shaft of most gear-motor and variable-speed units, and also can be placed inside the frame of squirrel-cage types.

Dickson Automatic Clutch Company, 606 South Hill Street, Los Angeles, California, is the manufacturer.

RECTORHEAD

SUCCESSOR TO THE BRADEN HEAD

MADE ITS SUCCESS THE HARD WAY!

We know of no better recommendation for the RECTORHEAD than the fact that nearly every user of this Head today made his original RECTORHEAD purchase to get out of trouble, or to avoid what he knew would otherwise be a trouble job. Customers like these, who where convinced the hard way, know the many advantages of the RECTORHEAD over conventional Braden heads, and have standardized on it. More than 7000 RECTORHEADS in the field today are the foundation of the wells they're protecting.

Receipt of the coupon below will bring you the whole story of the RECTORHEAD. Fill in and mail *now*.

The high pressure RECTORHEAD, with the Adapter flange.

CLIP COUPON FOR NEW 1937 CATALOG

NAME_____

STREET ADDRESS_____

CITY_____ STATE_____

RECTOR WELL EQUIPMENT CO. INC.

FORT WORTH, TEXAS

WICHITA FALLS MIDLAND TULSA SHREVEPORT HOUSTON

G-E Rotating-Cam Switches

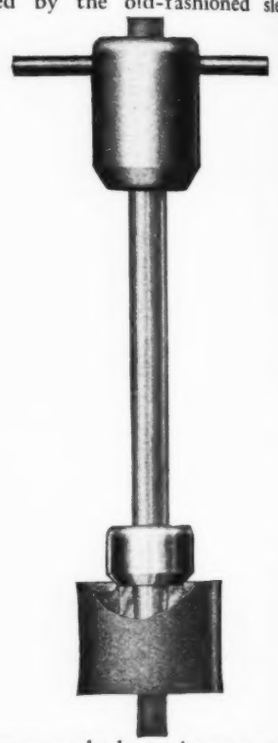
A NEW line of rotating-cam switches, designed especially for built-in control applications and adaptable to a variety of electrical functions and machine requirements, has been placed on the market by the General Electric Company, Schenectady, New York. For non-built-in applications, the devices are available as standard switches without the flanges used for flush-mounting on machines. Designated as G-E CR3300 rotating-cam switches, the new line is manufactured in a number of electrical and mechanical modifications making it universally adaptable to applications varying from machine-tool motor control to steel-mill master switching.

Two sizes are available: Size 0, rated 15 amp. continuous, and size 1, rated 25 amp. continuous, both for 600 volts or less, alternating current. Four standard types are obtainable, as follows, for controlling: (1) single-speed motors for reversing application; (2) two-speed, separate-winding motors for non-reversing application, or for one speed forward and one speed reverse; (3) two-speed, single-winding motors for non-reversing application, or for one speed forward and one speed reverse; and (4) three- or four-speed motors for three or four speeds forward and one speed reverse. In addition, special sequences are obtainable and forms of the switches with off-

position contacts are available. The switches also can be used as circuit-transfer switches.

Red Devil Piston Knocker

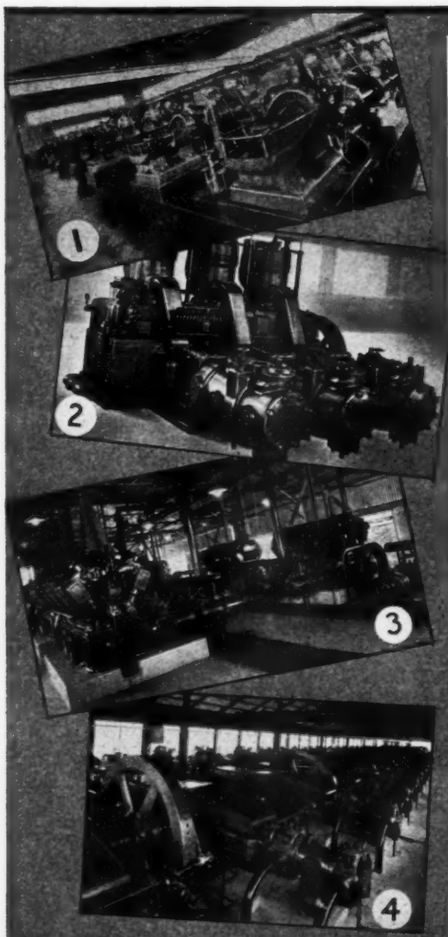
OIL Well Manufacturing Corporation, Los Angeles, announces the Red Devil Piston Knocker that is said to remove stuck tapered-type pistons quickly and easily without the damage to pistons and piston rods caused by the old-fashioned sledge-



hammer method of piston removal. The tool is made of forged steel and will last indefinitely, according to the manufacturer.

The Red Devil Piston Knocker is available in three sizes for use on 2½-in., 2¼-in., and 2-in. diameter piston rods, and is fully illustrated and described in literature available by writing the Oil Well Manufacturing Corporation, 6000 South Alameda Street, Los Angeles, California.

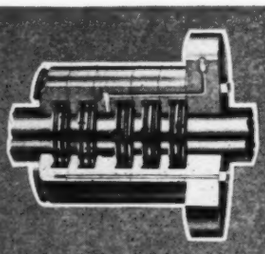
Seal your reciprocating piston rods
the way so many engine and compressor builders do . . . with
COOK'S METALLIC PACKINGS



Any engine or compressor is a more efficient unit if its rods are fitted with COOK'S METALLIC PACKING. The leading engine builders recognize this fact. Noteworthy applications are represented by the equipment, shown in the accompanying illustrations, that comes factory-equipped with COOK'S PACKINGS.

There is an approved type for all pressures fitted with packing rings made of COOK'S GRAPHITIC IRON, Cookmet, Babbitt or Micarta, as the requirements of service suggest.

For existing equipment, communicate with us direct or our nearest branch office.



1-COOPER-BESSEMER CORP.
2-CLARK BROTHERS COMPANY
3-INGERSOLL-RAND COMPANY
4-WORTHINGTON P&M CORP.

C. LEE COOK
MANUFACTURING CO.
INCORPORATED
LOUISVILLE, KY.
NEW YORK • LOS ANGELES • CHICAGO
NEW ORLEANS • CLEVELAND • TULSA
BALTIMORE • SAN FRANCISCO

Walworth Gate Valves

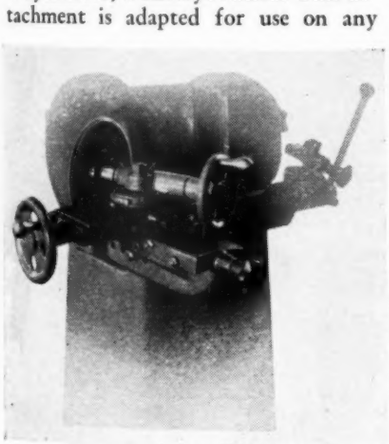
HEAVY wall thicknesses, deep stuffing boxes, oversize stems, streamline flow and steel handwheels with fluted non-slip rims, are some of the latest engineering features in-

cluded in the new Walworth steel gate valves, manufactured by the Walworth Company, New York City. They are now available for 150-lb. and 300-lb. steam pressures.

Made of carbon molybdenum steel (identification symbol C-1) to A. S. T. M. specifications A-157-36, they meet the requirements of all applicable specifications, the makers state.

Roller Cutter Disc Grinding Attachment

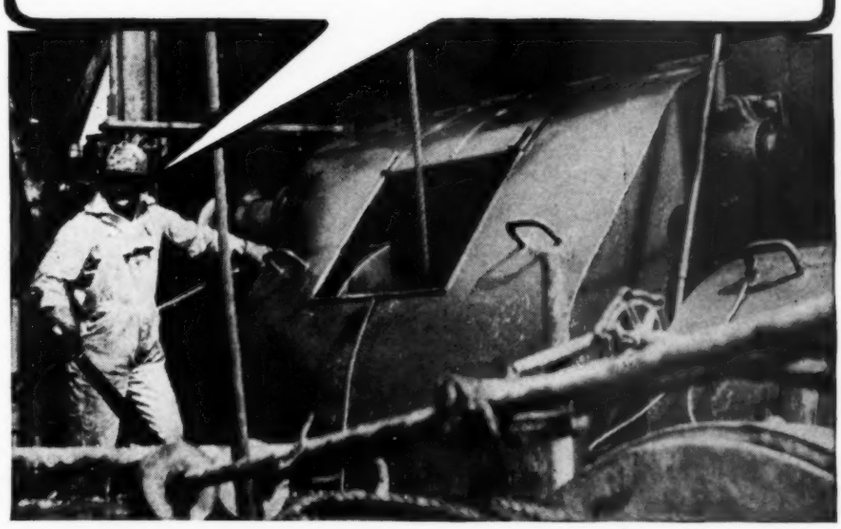
A grinding attachment for resharpening cutter discs as used on a roller pipe cutter is being marketed by the Landis Machine Company of Waynesboro, Pennsylvania. This attachment is adapted for use on any Landis Chaser Grinding Machine and was particularly designed for regrinding cutter discs used on the Geist Roller Pipe Cutter for which the Landis Machine Company is the exclusive selling agent.



By removing the steady rest in front of the straight wheel on the Landis Chaser Grinder, room is provided for bolting the disc cutter grinding attachment directly to the machine bed. The attachment will take discs of 6-in., 7-in., or 8-in. diameter. The cutter disc is mounted on the end of a cutter shaft that is adjustable in a horizontal plane for obtaining any desired bevel on the cutting edge. A hand wheel on the opposite end of the cutter shaft permits revolving the cutter disc against the face of the grinding wheel in order to grind uniformly its entire circumference. In-feed is provided by means of the hand knob at the front of the attachment and cross traverse by the hand wheel at the left of the attachment, which permits withdrawal of the slide for mounting and removing the cutter disc.

The accompanying illustration shows a cutter disc grinding attachment applied to a Landis No. 1½ chaser grinding machine.

HERE'S A LINING THAT CAN STAND THE GAFF!



TOM SINGLER operating one of the largest and best drilling rigs in the Corpus Christi oil fields, owned by W. A. Richardson Petroleum & Drilling Corp., and equipped with J-M Giant Rotary Lining, Style 410. Both owner and driller are sold on the superior, longer service of this rugged brake lining.

Here's why J-M Lining, Style 410 is the choice on so many Drilling Rigs:

AN EVEN FEED-OFF
. . . assuring better controlled drilling.

LESS SMOKING AND DUSTING
. . . working conditions greatly improved.

SCORING TENDENCY REDUCED
. . . life of brake rim is lengthened.

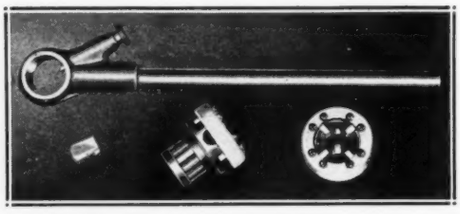
QUIETER BRAKES
. . . less nerve strain on drilling crews.

Johns-Manville
GIANT ROTARY LINING
Style 410

WRITE NOW—for full details on our complete line of friction materials. Address Johns-Manville, 22 East 40th Street, New York City.

Beaver Ratchets

BEAVER Pipe Tools, Inc., Warren, Ohio, announce several new ratchets for threading pipe, the No. 2 Beaver Open-Ratchet, the No. 6-R Beaverette Ratchet, and the No. 60-R Ratchet. The No. 2 Open-Ratchet threads pipe of ⅛-in. to ¾-in. diameter, and uses the same dies as the No. 3 Enclosed-Ratchet manufactured by the same company. Dies can be inverted for threading close to walls, and can be removed for resharpening. The No. 6-R Beaverette Ratchet threads ¼-in., ⅜-in., ½-in., and ¾-in. pipe without changing dies or bushings. It is instantly adjustable for cutting oversize or undersize threads. The universal pipe guide centers the pipe accurately. Close nipples can be cut with this tool. The No. 60-R Ratchet has a size range of ¼ in. to 1¼ inches. Dies are quickly changed and are fully adjustable for cutting standard, oversize, or undersize threads. A 3-jaw self-centering chuck centers the pipe; there are no bushings or grip screws. Threading dies are well above the face of the stock, are easy to oil, and the chips fall away readily.



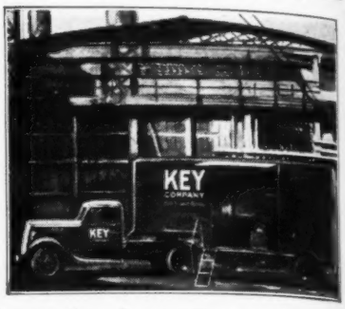
No. 2. Beaver Open-Ratchet

No. 6-R. Beaverette Ratchet

No. 60-R Ratchet

Traveling Machine Shop

THE Key Company, East St. Louis, Illinois, manufacturers of return bend fittings for oil refinery stills, now offers refineries the services of a fully equipped traveling machine shop. This



innovation in service consists of a large truck, containing all the special equipment necessary to handle a complete reconditioning job on return bend fittings. It is manned by experienced mechanics and travels direct to the refinery yard.

The new reconditioning truck is fully equipped to install renewable alloy steel seats in plug holes and remachine old plug holes or U-bends to fit new alloy seats. This motorized machine shop allows headers to be overhauled without removing the fittings from the tubes.

Typical industrial installation — one of several Marley forced draft towers purchased by a large food processing organization.
MORE water is cooled by Marley water cooling systems than by any other kind -- because Marley design and Marley performance provide maximum cooling efficiency.
THE MARLEY COMPANY
KANSAS CITY, MISSOURI
MARLEY
WATER COOLING SYSTEMS

BS&B Automatic Chemical Feeder

As a new addition to its extensive line of crude oil treating and dehydrating equipment, Black, Sivalls & Bryson, Inc., of Oklahoma City, Oklahoma, has recently announced an Automatic Chemical Feeder. This gas-powered unit was designed for injecting treating chemicals at high pressure into flow lines carrying emulsified crudes.

One of the outstanding features of this new gas-powered chemical feeder is the fact that it will inject chemical against the highest known operating pressures with only 20 or 25 lb. per sq. in. gas pressure, the manufacturers state. Power for driving this chemical feeder is derived from the energy stored up through putting gas into a large expanding diaphragm, and diverting that travel of expansion directly to a small diameter plunger. This feeder is easily connected, operates on low lease gas pressure for power, has no rotating parts, requires no lubrication, and it is a marked departure from the conventional gas turbine heretofore used as a source of power for driving chemical

feeders where no power other than gas pressure was available. This new automatic feeder has a wide range of volumetric delivery, it being capable of delivering as little as ½ pint per 24 hours, to as high as 20 gal. per 24 hours. Gas consumption is very low, requiring only 380 cu. ft. of gas at 20 lb. per sq. in. to pump one gallon of chemical with ⅜-in. plunger.

The feeder is a self-contained unit in that the pump and motivating diaphragm and a 10-gal. chemical reservoir are all built into one unit.

LESS LOAD PER CUTTER
MORE HOLE PER RUN!

3 CUTTERS on the MacClatchie wall scraper give you, not only the many advantages of smooth, STABILIZED performance, but also more **full gauge** hole per run. Each cutter carries only one-third of the total load, which means less wear per cutter and more even distribution of torsional strains on the body and blades. Result . . . a smooth, even performance that is easy on the drilling string, that absolutely eliminates egg-shaped holes, and that actually gives more **full gauge** hole per run in all formations.

Now check these additional features!

TREMENDOUS BODY STRENGTH . . . by the use of alloy steels, correctly shaped and properly heat treated. Note how body is shaped to reinforce the blades.

POSITIVE CUTTER EXPANSION . . . that gives an unmistakable signal when the blades are expanded. No worry, no wasted round trips. You know it's working for you every minute it's in the hole.

DUO-ACTION CIRCULATION . . . that provides positive circulation at each cutter PLUS additional circulation right through the body to the pilot bit below. This is invaluable when working through bridges and other obstructions in the hole where circulation on the pilot bit is an absolute necessity.

No matter what your job, the MacClatchie will do the work quicker, smoother, and more reliably. Contact your nearest MacClatchie representative for complete information.

Mac CLATCHIE MANUFACTURING CO.

Compton, California **Houston, Texas**

Export: Geo. R. Woods, 17 Battery Place, New York City

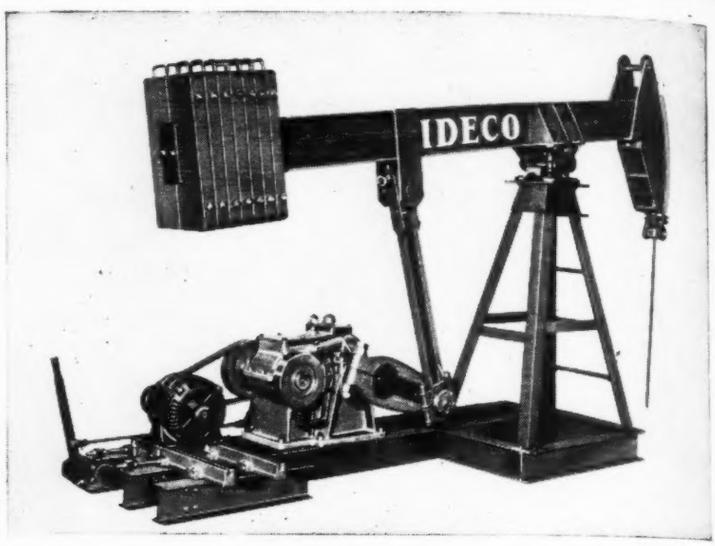
Indoor Oil-Circuit Breakers

THE Westinghouse 50,000-kva. indoor oil-circuit breakers are especially adaptable for use in limited space, the manufacturers state. They are manually or electrically operated, non-automatic or automatic, single throw with adaptable mounting arrangements and are comparable in performance to larger capacity breakers, it is stated.

All levers are enclosed within the tank and top. Other features include De-ion interrupter contacts, condenser bushings, single square tank, hydraulic bumpers, and silver-to-silver main contacts.

Small Geared Pumping Machine Developed for Light Wells

THE International Derrick and Equipment Company, Columbus, Ohio, has announced the addition of a small unit to its line of geared pumping machines. This new machine has a capacity of 11 hp. at 20 s.p.m. (proposed A.P.I. nominal rating) and a peak torque rating of 54,400 in-lb. The gear box is equipped with double reduction gears having an overall ratio of 31 to 1. The crankshaft is 4½-in. diameter and is mounted in bronze bearings. The intermediate and high-speed shafts are mounted in roller bearings. The gears are of continuous-tooth herringbone construction, cut on Sykes gear generators.



This machine is available in either single-crank or twin-crank construction. It may be supplied as a self-contained unit in which the gear box, samson post, and prime mover are mounted on skids, or it may be supplied less skids in which case the prime mover, gear box, and samson post are mounted directly upon concrete piers. This machine is designed for the application of either beam counterweights or rotary counterbalance.

The center iron bearings and the upper and lower pitman bearings are unusually heavy. The lower pitman bearing is equipped with Timken roller bearings and is completely sealed to retain the Alemite lubrication and to exclude water and dust. The upper pitman bearing is bronze-bushed and completely sealed. It is lubricated by means of wick oilers that deliver the lubricant to the top of the trunnion. The lubricant circulates around the journal and collects in a reservoir under the bearing. The center iron bearing is babbitt-lined and also is equipped with wick oiling lubricating means similar in construction to that used in the upper pitman bearing.

This machine has a maximum stroke of 42 inches. A mule head assures straight line motion at the polished rod. The mule head is of hinged construction, which permits it to be swung upward and laid back on top of the walking beam during servicing operations.

ANY PUMPING UNIT

. . . will get the job done after a fashion. But JENSEN JACKS are backed by the experience of succesful producers who have cooperated with us for 19 years in perfecting pumping equipment.

JENSEN JACKS are more dependable and economical. Get in touch with your JENSEN dealer or wire us at Coffeyville.

JENSEN BROTHERS MANUFACTURING CO.

. . . . *Coffeyville, Kansas*

STRAIGHT TALK.... *about* CROOKED HOLES

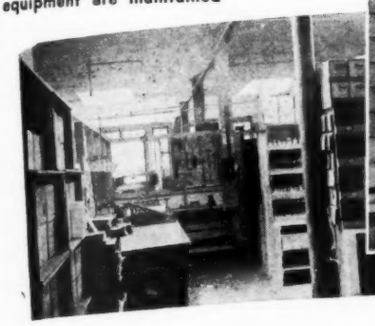
Write for literature

SPERRY-SUN WELL SURVEYING CO.

1608 Walnut Street, Philadelphia, Pa.
425 Petroleum Building, Tulsa, Okla.
3118 Blodgett Avenue, Houston, Texas
549 East Bixby Road (3800 Block—Atlantic Ave.) Long Beach, Calif.
Bank of Lafayette Building, Lafayette, La.
c/o Elks Club, 17th and I Sts., Bakersfield, Calif.

Ensign's Chicago Branch

Behind the scenes with Ensign in Chicago. Here complete stocks and mechanical equipment are maintained



Exterior view of the Ensign Carburetor Company's Chicago branch at 2644 South Michigan Avenue

Ensign's Chicago Staff, the lads and lassies behind that prompt service to Ensign customers in the east and midwest

IF many readers usually think of Huntington Park, California, as the Ensign Carburetor Company's address, it is only psychology's law of association of ideas operating automatically.

The fact of the matter is that Ensign has another address much closer to home for many, namely 2644 South Michigan Avenue, Chicago.

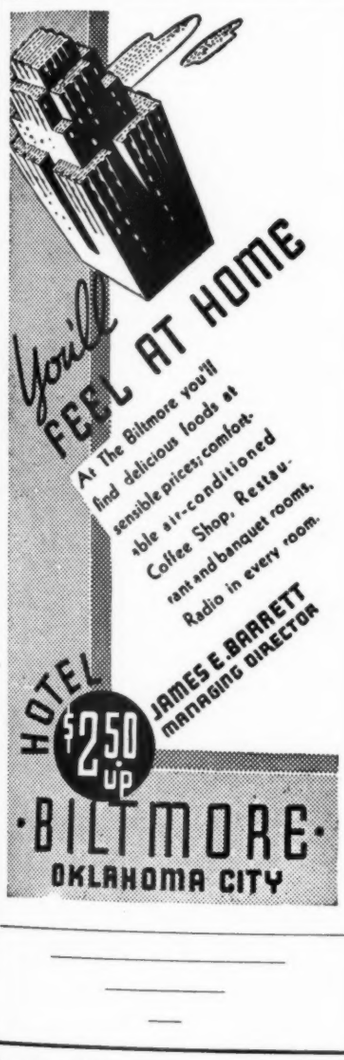
At this address this well-known manufacturer of carburetors maintains a fully-equipped, stocked, and manned branch for the convenience of Ensign customers in the east and midwest. Kept on hand at all times are large numbers of Ensign gasoline, natural gas, and combination gas and gasoline carburetors, fuel regulators, heat exchangers, and auxiliary equipment for conversion to these fuels; as well as natural gas and butane-propane adapter assemblies for Ford V-8 power units. The company manufactures carburetting equipment for all fuels and for all types of automotive, stationary, and marine engines.

Special attention is given calls for replacement parts, according to C. F. Keene, Ensign's Chicago manager. Mechanical facilities for repair and special order service also are maintained and trained workmen schooled in Ensign's high precision standards handle all jobs.

Several views of this efficient Ensign branch are shown here, also a picture of members of the office and shop staffs.

International Supply Adds Stores

In line with their expansion program International Supply Company announces the opening of two new stores and a branch office. The office is in the Bitting Building, Wichita, Kansas, with R. L. Neal, district manager, and D. H. Collins, salesman. A new store at Great Bend, Kansas, is managed by R. T. Cheney, under supervision of the Wichita office. G. E. "Burt" Ponder is manager of a new store at Odessa, Texas, under the direction of W. A. Chaney, district manager at Midland, Texas.


You'll FEEL AT HOME
At The Biltmore you'll find delicious foods at sensible prices; comfortable air-conditioned Coffee Shop, Restaurant and banquet rooms. Radio in every room.
JAMES E. BARRETT MANAGING DIRECTOR
HOTEL
$2.50 up
·BILTMORE·
OKLAHOMA CITY

COME TO HOUSTON
Enjoy THE BEST IN LOW COST Luxury
Here's a tip! For a pleasant stay in Houston, stop at the Texas State. You will enjoy everything about this hotel from the moment you enter. It's a refreshing and welcome relief, yet it costs you no more than ordinary hotels.
The Texas State is Houston's newest, most modern hotel.. Both tub and shower in every room. Next time you're in town, try the Texas State.
LOW AS $2.50 PER DAY
TEXAS STATE
★ HOTEL ★
B.F.ORR General Mgr.

CLEAN OUT YOUR WELLS QUICKLY AND ECONOMICALLY

With the IMPROVED

MILLER Sand Pump

Sand and mud is holding back your oil—clean out your well so it will produce its full production. The powerful suction action of the plunger in the MILLER enables it to clean out faster than any other sand pump or bailer.

The MILLER made out of the ¼" wall thickness and with Chisel Bottom attached gives sufficient weight, that often tools are not needed in cleaning out.

MILLERS are now made in two weights of tubes—$\frac{5}{32}$" wall thickness in Regular and ¼" wall thickness when Heavy sand pumps are needed.

SAND BOTTOM

Used when tools are run and when well is shot to quickly remove loose material.

STAR BOTTOM

Used for cutting the sand loose.

BAILER BOTTOM

With the Bailer Bottom installed the Miller is changed to a Bailer, giving you a combination of either a Bailer or Sand Pump in one tool.

MILLER SAND PUMPS ARE SOLD BY SUPPLY COMPANIES EVERYWHERE

Write for Descriptive Folder and Price List

CHISEL BOTTOM
(In Pump)

Will often save the expense of running tools, as its chisel shape breaks up tightly-packed sands.

MILLER SAND PUMP CO.

Gen'l Offices and Shop, Box 5416
OKLAHOMA CITY, OKLA.

Branch Shops and Offices:
Sapulpa, Okla., and Kilgore, Tex.

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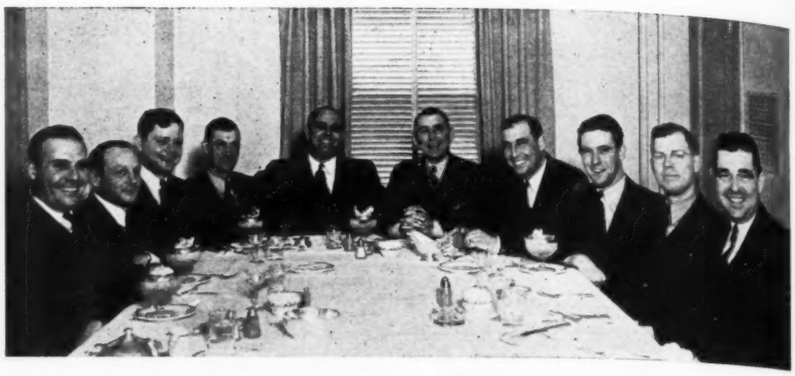
BJ Holds Sales Banquet



To discuss sales plans in the Mid-Continent and Gulf Coast areas, the Oil Tool Division of Byron Jackson Company recently held a sales meeting and banquet at Fort Worth, Texas. Pictured here from left to right are: Herb E. Grau, chief engineer, visiting from Los Angeles; Marshall Moore; D. O. Pugh; R. T. Todd; Frank Champion, general sales manager; C. F. Vincent, Mid-Continent manager; B. A. Hilliard; Gordon Leaf; H. M. Turnage, and E. W. Stuart.

Union Wire Rope Corporation Elects Officers and Directors

The annual meeting of the stockholders and directors of the Union Wire Rope Corporation was held at the company's Tulsa offices on March 23rd. A. F. Beringer, president of P. W. Brooks and Company, Inc., of New York, was elected to the board of directors, succeeding Frank L. Moore, who recently resigned.

R. H. BARTLETT

H. R. GRUBER

Directors re-elected were: R. H. Bartlett, Tulsa, Oklahoma; M. G. Ensinger, Kansas City, Missouri; H. R. Gruber, Tulsa; H. O. McClure, Tulsa; Phil D. Morelock, Washington, D. C.; and E. A. Reedy, Kansas City.

M. G. ENSINGER

Officers of the corporation elected for the coming year are: R. H. Bartlett, chairman of the board; M. G. Ensinger, president and general manager; H. R. Gruber, vice-president and sales manager; J. H. Hatch, vice-president and treasurer; J. C. Sell, secretary and assistant treasurer; H. M. Lawrence, assistant secretary and assistant treasurer; W. Voigtlander, chief engineer, assistant secretary, and assistant treasurer.

J. H. HATCH

New Brown Pyrometer Catalog No. 15-C

The Brown Instrument Company has just published a new catalog on Brown Pyrometers (millivoltmeter type).

This new catalog (No. 15-C) covers the complete line of Brown Millivoltmeter Pyrometers—indicating, recording, and controlling. It describes the new moisture-proof rotary switch, multiple-key type switch, control relays, valve mechanisms, thermocouples and accessories.

Pages 36 to 39 illustrate the Brown Optimatic (the self-balancing optical pyrometer), Brown Analy-Graph (for furnace atmospheres), Protectoglo (the combustion safe-guard), all recent additions to the Brown line.

Copies of the catalog will be sent free to those requesting them from The Brown Instrument Company, Wayne and Roberts Avenues, Philadelphia, Pennsylvania.

Grove Regulator Moves

The Grove Regulator Company has announced the removal of its office from 1072 Bryant Street, San Francisco, California, to its new factory at 1729 Poplar Street, Oakland, California.

I.P.A.A. Meeting at Houston October 14-16

It has been announced by Chas. F. Roeser, president of the Independent Petroleum Association of America, that the 1937 annual meeting of the association will be held at Houston, Texas, October 14, 15, and 16, during the Oil-World Exposition.

Engineers to Meet in Chicago

The thirty-fifth annual convention of the Universal Craftsmen Council of Engineers will be held at Chicago, Illinois, August 3 to 7, inclusive. Headquarters will be at the Stevens Hotel.

An exhibition of power equipment displayed by 150 prominent manufacturers in the power field will be held in conjunction with the convention.

Technical sessions will be addressed by nationally-known authorities on subjects of interest to engineers and power specialists.

Lincoln Appoints Welding Consultant

The Lincoln Electric Company, Cleveland, Ohio, announces the appointment of Don McCormick as arc-welding consultant for the Kansas City, Missouri, office, at 1818 Main Street.

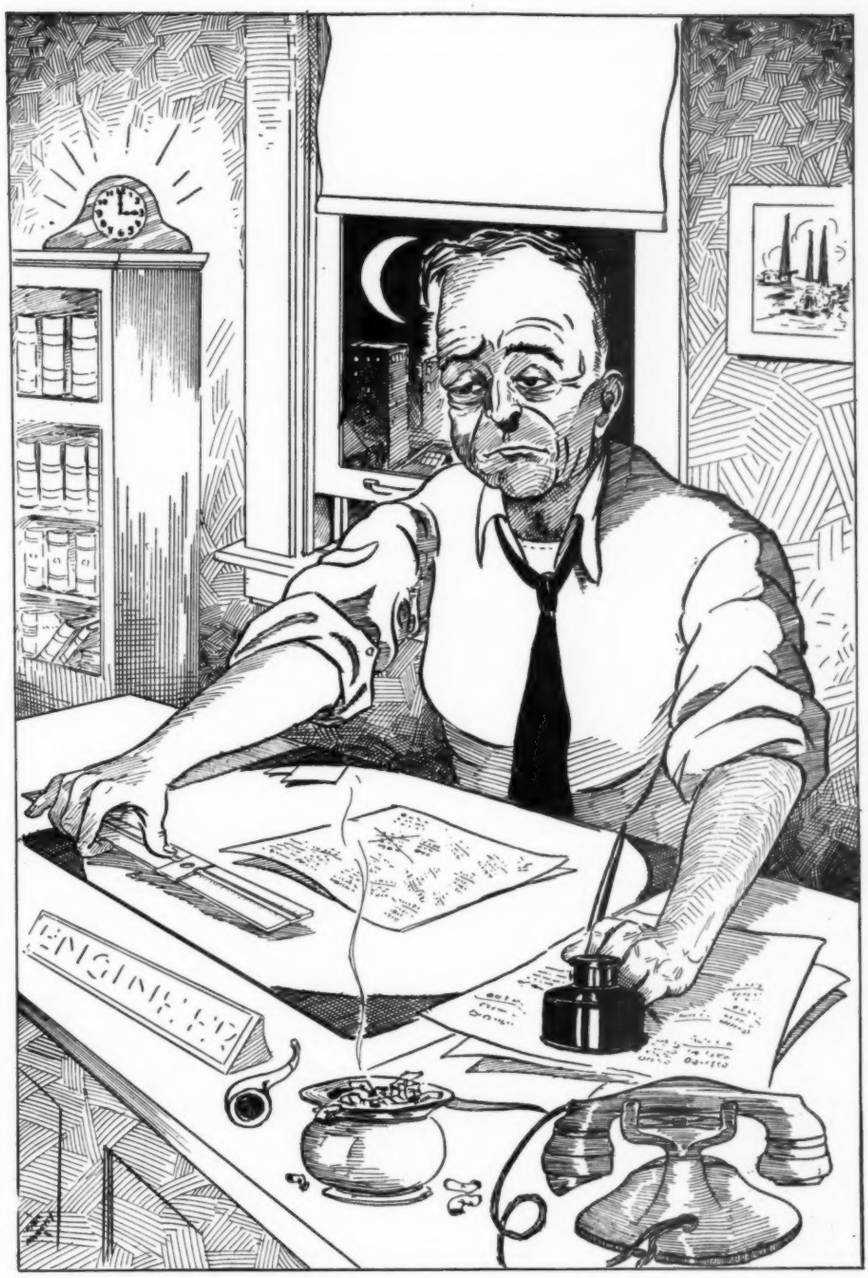
McCormick formerly was welding supervisor for the Sheffield Steel Company of Kansas City, and has had broad experience in the practical application of electric welding. His work will be under the supervision of E. D. Anderson who is in charge of the Kansas City office.

Cities Service to Erect Girbotol Process Plant

Cities Service Gas Company, Bartlesville, Oklahoma, has been licensed by The Girdler Corporation, Louisville, Kentucky, to build and operate a Girbotol Process plant near Lyons, Kansas, for the removal of hydrogen sulphide from natural gas.

The plant will purify 10,000,000 cu. ft. of gas daily for distribution to domestic and industrial consumers. The hydrogen sulphide content of the gas will be reduced from 135 to less than 1 grain per 100 cu. feet.

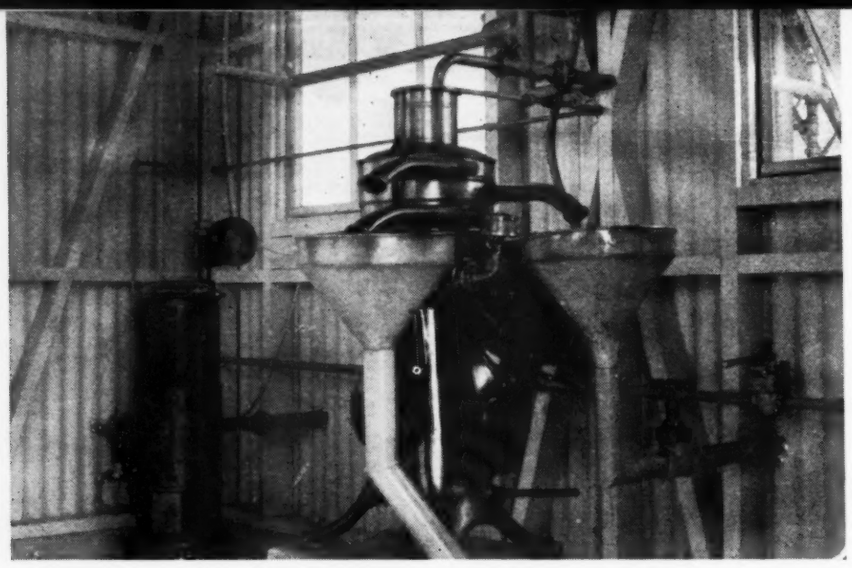
Construction of the plant will begin immediately with completion scheduled for early summer.



"Mister Engineer, it isn't necessary—

PURCHASED ELECTRIC POWER WILL SOLVE YOUR POWER PROBLEMS!"

HOUSTON LIGHTING & POWER COMPANY



Reclamation apparatus used by the Industrial Fuel Supply Company for salvaging crankcase oil at its compressor station at Dominguez Hill, California

Unit at Dominguez, California, station of Industrial Fuel Supply Company makes possible repeated use of lubricating oil

Reclaiming Crankcase Oil at Compressor Station » » »

THE Industrial Fuel Supply Company, operating pipe lines in Southern California, transporting natural gas from various gasoline plants in the oil fields to densely populated communities and cities on the West Coast, has a number of compressor stations, among which is one on Dominguez Hill, about seven miles northwest of Long Beach. Several extensions have been made to this compressor station and its capacity greatly increased in order to handle the increasing volume of stripped natural gas produced with the oil as the field has gradually developed. There are 23 gas-engine-driven compressors in operation at this station, handling approximately 30,000,000 cu. ft. of gas daily.

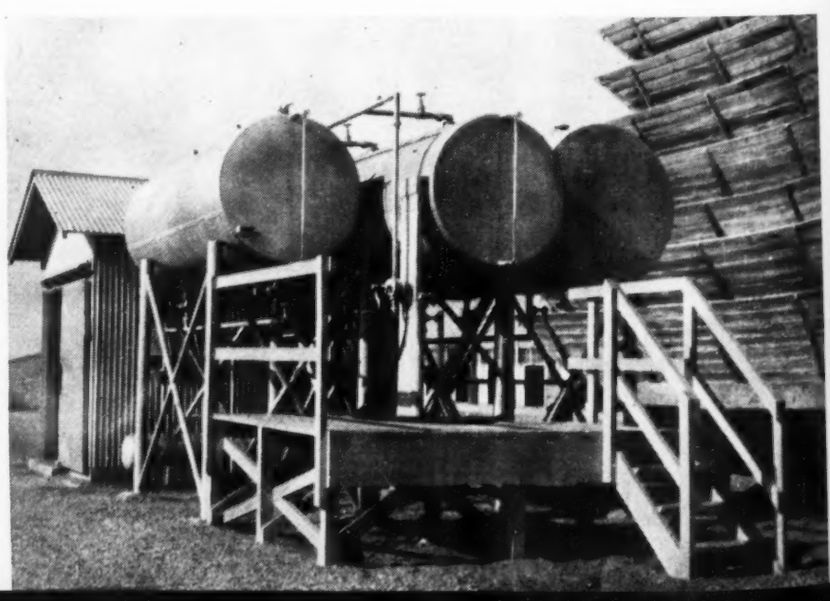
All engines are overhauled periodically, and all used oil in the crankcases drained out and replaced with fresh lubricant. The problem that faced this company several years ago was that of reconditioning the used crankcase oil so that it could be used again and yet again. Several different methods were investigated, and the objective always kept in mind was low operating and maintenance costs. A method finally was adopted involving the use of a centrifuge, operating on heated dirty oil.

When an engine is being overhauled or when it is time to replenish the oil in the crankcase, the used oil is drained from the units into drums placed on the engine room floor. After draining an engine, the used oil is carted to the filtering, or reclamation, unit. Two horizontal tanks installed upon a rack made of pipe, hold the used oil. The drum, or drums, are placed on a platform beneath the tanks and the oil removed by hand-operated rotary pump that elevates it to the proper receptacle.

A small steel building erected near the tanks contains the reconditioning equipment, which consists of a gas-fired oil heater, an electric-operated centrifuge and sludge tanks, and pipe lines for carrying the oil to and from the centrifuge. The tanks containing the old oil are elevated so that the oil can flow by gravity to the reclamation equipment, thus saving the expense of pumping it several times while processing. Heating is accomplished by using a 55,000-B.t.u. water heater, of a type sometimes used in large homes for heating water. The heater is equipped with a mercoid switch connected to a "magnet valve" for shutting off the supply of gas should the temperature rise above the predetermined limit. The centrifuge is operated by an electric motor. A thermostat placed in the fuel line controls the temperature of the oil leaving the cast-iron heating element in the oil heater.

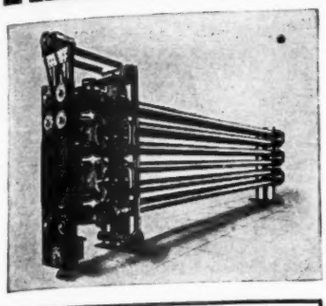
At the desired temperature the dirty oil flows by gravity from the elevated dirty oil storage tanks through the heater to the centrifuge; there the clean oil flows out through the usual spout, the sludge and other refuse flowing down through a pipe to a concrete pit outside for future disposal. The clean oil flows through a similar line to a horizontal drum outside the building that can be closed when full and emptied by gas pressure. A horizontal tank erected beside the two oil tanks containing dirty oil is used for storage of the cleaned oil.

Being equipped with automatic heat-controlling units, the cleaning equipment requires no attention from the operators of the compressor station after it has been adjusted for temperature and rate of flow. D. H. Toler, superintendent of the compressor station at Dominguez Hill, says that even with the emulsion removed from the old oil, replenishing the crankcase supply with new oil is unnecessary, because a sufficient amount of lubricant for make-up purposes passes through the packing on the piston rods of the compressors and power cylinders. The unit at Dominguez Hill has been in service for more than a year, and tests made on the reclaimed oil show that it has all the required qualities for a satisfactory crankcase lubricant.



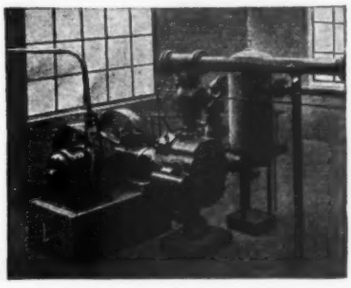
Tankage used for dirty and for reclaimed crankcase oil

1937 MODERN EQUIPMENT for 1937 REFRIGERATION and DEWAXING



Carbondale Heat Exchanger

Now is the time to prepare for next season's requirements.



Horizontal Booster, in refinery service

COMPRESSION REFRIGERATION SYSTEMS
Single and 2-Stage
ABSORPTION REFRIGERATION SYSTEMS
FILTER PRESSES

Carbondale engineers, with a background of 40 years of refinery refrigeration experience, stand ready to discuss your needs.

Ask for bulletins

CONDENSERS AND BRINE COOLERS
OIL COOLERS AND HEAT EXCHANGERS
CHILLING MACHINES
for Distillate and Solutions

CARBONDALE
DIVISION
CA7-8
WORTHINGTON PUMP AND MACHINERY CORPORATION

ATLANTA BOSTON BUFFALO CHICAGO CINCINNATI CLEVELAND DALLAS DENVER DETROIT EL PASO HOUSTON KANSAS CITY

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KEEP STEPPING - - -

with "CLEVELANDS"

Dig Anywhere . . . Anytime

"CLEVELANDS" have the in-built ability to step out and keep going as owners will testify.

This is due to "Clevelands" distinctive, time-proven, patented design, embodying many practical features, paving the way for high capacity and continuity of performance regardless of conditions.

Best of all "Clevelands" keep stepping because of their modern simplified construction of unparalleled quality which assures strength and resistance to wear and prevents costly delays. You can depend upon "Clevelands" to get the job done and at minimum expense. Before you dig ditch investigate "Clevelands"—it will pay you.

THE CLEVELAND TRENCHER COMPANY
Pioneer of the Small Trencher
20100 ST. CLAIR AVE. CLEVELAND, OHIO

One important "Cleveland" idea. High-speed, low-cost transportation via special trailer. Load or unload in 10 to 15 minutes. Machine-savings made available even on scattered short lines, "Hot-spot" reconditioning, etc.

CLEVELANDS

New Bureau of Mines Plant at Bartlesville Completed

A new administration building, involving an expenditure of $250,000, has been completed at Bartlesville, Oklahoma, by the United States Bureau of Mines, and is one of the finest of its kind in the world. The new building is so constructed that the original administration building, constructed in 1918 and remodeled in 1934, is now the south wing of the complete plant. The central part of the new building is 100 ft. long by 50 ft. wide, is three stories high, and has a basement. It houses the offices of the various engineers and officials, the library-reading room, and two floors of laboratories. The building is fireproof, contains many other safety features, and is air-conditioned.

N. A. C. Smith is supervising engineer and superintendent of the Experiment Station. Ludwig Schmidt and W. B. Berwald are senior engineers; R. E. Heithecker, H. M. Smith, and M. A. Schellhardt are engineers and chemists; E. J. Dewees, J. W. Horne, Peter Grandone, Boyd Guthrie, D. B. Taliaferro, C. J. Wilhelm, and Kenneth Eilerts, associate engineers and chemists. In addition there are numerous technical assistants and sub-professional employees.

Open house will be held May 15th, at which time the public will be permitted to inspect the new plant.

NATIONAL BANK OF TULSA

TULSA, OKLAHOMA

Statement of Condition March 31, 1937

RESOURCES

Cash and Due from Banks	$18,965,747.95	$
U. S. Government Securities	18,025,168.60*	
Other Bonds and Warrants	7,161.623.08*	$44,152,539.63
Loans and Discounts		14,906,289.29
Overdrafts		5,298.21
Income Receivable Accrued		185,129.22
Stock in Federal Reserve Bank		180,000.00
Investment in Bank Premises		2,310,514.85
Customers' Liability Under Acceptances		9.158.70
TOTAL		$61,748,929.90

LIABILITIES

Deposits		$55,359,444.00
Acceptances Executed		9,158.70
Income Collected Not Earned		78,355.28
Interest, Taxes, etc., Accrued		73,679.55
Reserve for Preferred Dividend		13,125.00
Capital—Preferred	$1,750,000.00	
Capital—Common	2,250,000.00	
Surplus	2,000,000.00	
Undivided Profits and Reserves	215,167.37	6,215,167.37
TOTAL		$61,748,929.90

*Of the total of $25,186,791.68 U. S. Government Securities and Other Bonds and Warrants $14,984,711.15 mature within five years.

COMPARATIVE DEPOSITS

March 31, 1934	$34,014,106.94
March 31, 1935	39,269,375.86
March 31, 1936	49,688,027.17
March 31, 1937	55,359,444.00

The Oil Bank of America

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

Bruce Gold Sales Engineer With Atlas

Atlas Supply Company announces the appointment of Bruce E. Gold, formerly with the engineering department of the Caterpillar Tractor Company, as sales engineer, with headquarters at Tulsa, Oklahoma.

BRUCE E. GOLD

Prior to his connection with Caterpillar, Gold was assistant chief engineer of the Weber Engine Company, Kansas City, and brings to his new connection a wide experience in oil industry operations and power mechanism.

Waverly Handbook Out This Month

The Waverly Oil Works Company, Pittsburgh, Pennsylvania, announces that the ninth edition of the Waverly Handbook will be published April 20th. This volume, with more than 900 pages, contains technical, engineering, and chemical data pertaining to the petroleum industry.

Written and edited by some of America's outstanding engineers and chemists, the new edition contains special articles never before published, relating to various processes of refining, petroleum standards, and lubrication problems, both industrial and automotive. Included also are hundreds of useful reference tables, a business law section, and more than 100 pages of Waverly formulas.

Trade Personals

R. E. ROSAIRE has resigned as president of the Independent Exploration Company, Houston, Texas, to devote his time to experimental work in geophysics and geochemistry.

●

J. M. FULLER, Fort Worth, Texas, on April 1 was appointed Mid-Continent sales representative to the oil and gas industry for the France Packing Company, Tacony, Philadelphia, Pennsylvania.

●

WOODWARD COULTER BENNETT is the name of a nine and a half pound youngster who arrived March 17 at the home of Mr. and Mrs. Ward Bennett, Oklahoma City, Oklahoma. The elder Bennett is with the National Supply Company.

●

MARCEL SCHLUMBERGER, president of the Schlumberger Well Surveying Corporation, is visiting the Houston headquarters of his organization, as well as the different field crews. Schlumberger arrived in the United States from Paris after an extensive trip in South America, where he has been studying thoroughly the oil fields of Venezuela and Trinidad.

●

FRED WALLACE, Link-Belt manager of oil industry sales, left Houston, Texas, recently by air to spend about a month in California fields, returning through the Rocky Mountain and Mid-Continent districts.

●

H. P. MEE, vice-president of Caterpillar Tractor Company, Peoria, Illinois, has resigned, effective June 1, to devote his entire attention to his extensive citrus fruit interests in California. The press of executive work and administrative duties in connection with the supervision of all sales, service, and advertising activities at "Caterpillar" has required Mee's continued presence at the Peoria, Illinois, offices and plant. In the meantime, his citrus holdings in Southern California have been expanding, resulting in his decision to transfer his activities there. He probably will make his home in Santa Barbara.

●

W. H. BORST, graduate in mechanical engineering from the University of Illinois, and E. A. WEBBER, formerly with the company's Chicago office, have been appointed to the sales staff of the New York office of the Lincoln Electric Company, Cleveland, Ohio. The new men will assist G. N. BULL, manager, and F. H. ANDREWS, S. G. MORRIS, and J. B. CHAMBERLAIN, other members of the New York office staff. Announcement also is made of the appointment of JOHN S. HUMBLE as arc-welding consultant for the Boston office. He will work under the supervision of J. E. RANEY, who is in charge of the Boston office.

Daughter for Mr. and Mrs. Ray Humphreys

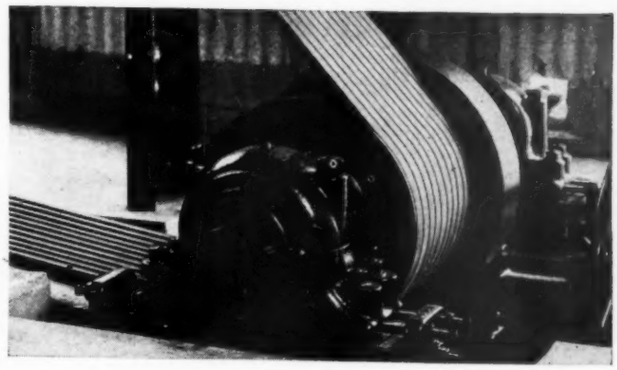
February 26, 1937, was just another day on the calendar to most people, but to Ray Humphreys, assistant to the president of Axelson Manufacturing Company, Los Angeles, it was a date of considerable moment.

RAY HUMPHREYS

On that day, at Mission Hospital, Huntington Park, came Sally Ann Humphreys, 10 lb. and 13 oz. of coquetry. Mrs. Humphreys is doing very well, thank you, as is Sally Ann. (Mr. Humphreys is slowly recovering.)

Incidentally, the Humphreys will soon stage a housewarming and hang out the latch-string at their new home in Whittier, California.

They're Rugged!



Dodge-Timken Bearings Aid Oil Field Production

That steady, severe, continuous service that BEARINGS encounter in the oil field "weeds" out the weaklings and brings out the leaders—Dodge-Timken Bearings, widely preferred by the industry are rugged aids to uninterrupted production . . . For normal or heavy service—for excessive dust or water conditions—there is a Dodge-Timken Bearing designed and built to insure satisfactory performance under every service condition . . . Specify Dodge, a leader in the field of power transmission . . . Send for catalog.

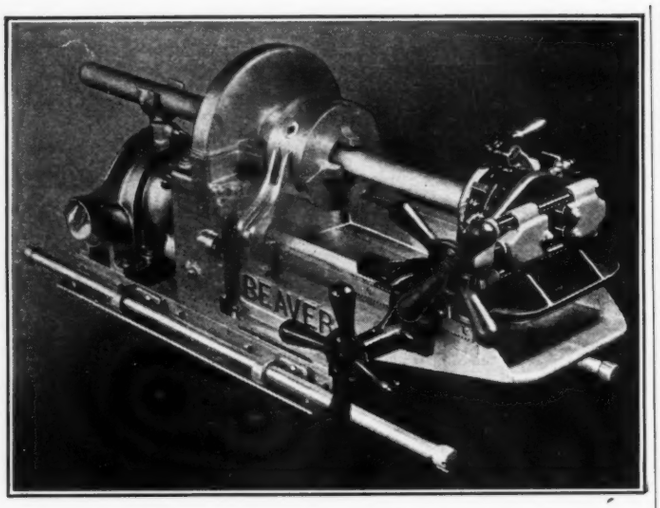
Let us send you a copy of this catalog which describes Dodge Rolling Bearings.

DODGE MANUFACTURING CORPORATION
MISHAWAKA, INDIANA
U. S. A.

THE Right DRIVE FOR EVERY JOB

● See the Dodge 20-page Section in the Oil Field Composite Catalog. ●

DODGE
MISHAWAKA
THERE IS ADDED VALUE IN THE NAME DODGE



Are You "Mechanically Inclined"?

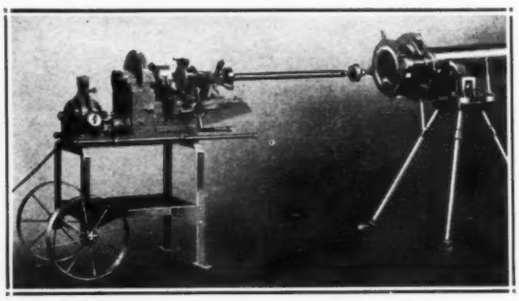
If so, you will appreciate the value of these three features of the Beaver Model-A Portable Pipe Machine.

1. Right-Handed. Conforming to standard machine tool design, the Model-A is right-handed like a lathe—with chuck to the left and tool-mounting and operating controls to the right. All controls in front—facing operator!

2. Full-Range. It covers the full-range ⅛ to 2-inch instead of the usual range ½ to 2-inch. It cuts, threads, reams and chamfers nine sizes instead of six sizes. Those extra sizes, viz: ⅛, ¼ and ⅜-inch are important in every industrial plant where small pipe is used for air-lines, lubricant lines, gases, etc.

3. Double-Duty. By virtue of its patented wheel cut-off, the Model-A will both cut and thread solid round bars—for making threaded rods, bolts, pipe hangers, etc. This extremely important service feature cannot be had efficiently from machines equipped with knife-type cut-off.

When you buy a pipe machine demand these three advantages. In the meantime write us for complete descriptive literature of the Model-A Beaver Special—priced at $295.00 complete, ⅛ to 2-inch.



With driveshaft and geared tools, the BEAVER Model-A will cut and thread 2½ to 12-inch pipe

BEAVER PIPE TOOLS

437 PETROL AVE. WARREN, OHIO

TRADE LITERATURE

A WELDING METHOD used in the construction of more than 5000 miles of cross-country pipe lines is discussed in "Lindewelding Pipe Lines," a 32-page (8½ x 11) illustrated booklet published by The Linde Air Products Company, New York. Features treated are the economy and rapidity of construction by Lindewelding, joint design, quality and strength of welds, and simplicity of field operations. Other subjects covered are the growth of pipe line welding since 1914, time and material records on typical Lindewelded lines, construction organization and methods, welding specifications, welding rod and technique, metallurgical considerations, multi-flame welding, and the all-bell-hole method. A list of oxy-acetylene welded lines laid since 1917 includes many well-known oil, gas, and gasoline pipe lines.

JUST OFF THE PRESS is a new bulletin by the Mine Safety Appliances Company illustrating and describing the MSA Combustible Alarm, an instrument for continuously sampling atmospheres where combustible gases and vapors may be present, and which provides an electrical warning when the concentration of flammable gases exceeds a pre-determined limit. The brochure is available by addressing the manufacturer at Meade, Thomas, and Braddock Avenues, Pittsburgh, Pennsylvania.

"THE DEPENDABLE DIESEL," published by the Cummins Engine Company, Columbus, Indiana, is an extremely handsome brochure describing that company's product. The book is profusely illustrated and beautifully bound. Within its pages will be found discussions of the Cummins Diesel with respect to the many and varied industries in which it is used, stressing particularly its versatility and adaptability. The book also contains much concerning the personnel of the Cummins Engine Company and its various distributors throughout the world.

DOWELL INCORPORATED, subsidiary of the Dow Chemical Company, Midland, Michigan, has issued an interesting folder describing its acidizing service. The publication is well illustrated and contains many interesting facts concerning the Dowell service, and such information as the number of gallons of acid used in treating oil wells during the last year, the number of miles the company's trucks have traveled during the same period, location of district offices, etc. Copies will be sent free upon request.

C. J. TAGLIABUE MANUFACTURING COMPANY, Park and Nostrand Avenues, Brooklyn, New York, has issued Catalog No. 900C that completely describes and illustrates the latest models of TAG non-indicating controllers for temperature, pressure, and time. In addition to the instrument listings, the book contains a comprehensive discussion of various types of TAG controllers, their applications, and how they work.

IN A NEW BULLETIN, No. 6165, Fairbanks, Morse & Company describes its duplex, self-oiling pumps for handling mud and slush, clear water, petroleum products, and other liquids. These sturdy pumps are offered as basic units; for belt drive; and with top-mounted or tandem-mounted motors. They are available with capacities from 23 to 94 gal. per minute and with pressures up to 475 lb. per sq. inch.

The same company has issued bulletin No. 1600 describing its line of polyphase wound-rotor or slip-ring, ball-bearing, induction motors.

* * *

AN INTERESTING new petroleum meter bulletin has been published by the Ralph N. Brodie Company. Operators of fuel oil and gasoline trucking equipment, loading-racks, etc., will find value in its clearly explained and illustrated outline of modern metered distribution. In addition the full line of Brodie meters, types, sizes and counter styles are shown. Copies can be obtained by writing the company, 971 61st Street, Oakland, California.

* * *

TECHNICAL BULLETIN No. 10, issued by the Steel and Tube Division of The Timken Roller Bearing Company, presents a series of data on oxidation at 1000 deg. fahr., 1250 deg. fahr., and 1500 deg. fahr., on 13 different steels. This bulletin will be of particular interest to designers and operators confronted with oxidation problems connected with cracking coils, polymerization plants, superheaters, high-pressure steam plants, air heating equipment, and recuperators. Copies of this folder may be obtained upon request to the Steel and Tube Division of The Timken Roller Bearing Company, Canton, Ohio.

* * *

J. F. Eaton Goes With American Steel Derrick Co.

John F. Eaton, for the last five years with the Jarecki Manufacturing Company as engineer engaged in sales and development work, has resigned to accept a position as mechanical engineer for the American Steel Derrick Company of Tulsa, Oklahoma. His headquarters will continue to be at Tulsa.

JOHN F. EATON

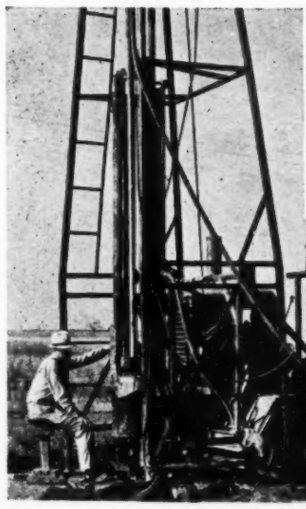
Before coming to Tulsa five years ago, he was a resident of St. Louis, Missouri. He graduated from Princeton in the class of 1931 with the degree of Bachelor of Science in engineering, having specialized in mechanical engineering.

After coming to Tulsa early in 1932, Eaton was active in the Young Engineers Club of Tulsa, the Petroleum Engineers Club, and assisted in the organization of the present Engineers Club of Tulsa. He also is a member of the American Society of Mechanical Engineers and the American Petroleum Institute.

Made Vice-President Axelson Mfg. Co.

The appointment of Alvin Zwerneman as vice-president of the Axelson Manufacturing Company, Los Angeles, has been announced by J. C. Axelson, president. Zwerneman's appointment became effective March 1st. His connection with the company has extended over a period of nearly 12 years. He is well-known in both the Mid-Continent and California fields. His activities will continue to center around the direction of selling and field service.

ALVIN ZWERNEMAN



FRANKS PORTABLE ROTARY
With Hydraulic Feed

A Franks Small Portable Rotary operating in Kansas on 2,000 ft. wells

Faster drilling. Safer operation. Ready portability. Rig up and tear down in 15 minutes. Two models, for 2,000 ft. holes and for 3,000 ft. holes. *Lower Cost* for shallow production and exploration deep core work. Write for information or a demonstration.

Our Catalog Is Filed in the Composite Catalog
See Pages 590 to 596

FRANKS MFG. CORP.
WELL SERVICING AND DRILLING UNITS

P. O. BOX 137 WHITTIER STA. TULSA
Export Office: 149 Broadway, New York.

Effective for Every STEAM-REDUCING PURPOSE

Whatever steam-reduction you require, there is a C-F Regulator of the Level and Weight type to accomplish it. The regulator here shown is for low-pressure heating systems, where initial pressures as high as 200 pounds must be reduced to delivery pressures of 5 or 10 pounds. Sizes of 1 to 2 inches can be provided with outlets of greater diameter.

Chaplin-Fulton Regulators have been used and approved for fifty years. Advice as to type and specifications for any particular requirement will be gladly given.

THE CHAPLIN-FULTON MFG. CO.
28-40 Penn Ave. Pittsburgh, Pa.

Buckeye

50 Clipper

METERED
• VACUUM •
CONTROL

1/2 YARD

. . . as easy as driving a car!

OPERATES AS EASILY AS DRIVING A CAR. Every operation is maintained by a METERED VACUUM SYSTEM — never affected by temperatures, small leaks or water in the lines. The touch and feel of each lever — so essential to accurate operation — is there. All operator's movements are practically effortless. The Clipper has the handiest, most comfortable cab on any machine, with full vision safety glass windows — and it has METERED VACUUM CONTROL.

THE LAST WORD IN EXCAVATOR ENGINEERING. Send for literature or arrange to see the Clipper before you buy any ½ yard excavator this year.

Convertible

SHOVELS • CRANES • TRENCH HOES • CLAMSHELLS • DRAGLINES

BUCKEYE TRACTION DITCHER CO. - FINDLAY, OHIO

No Seams—

—Greater Strength

Hough Working Barrels are *seamless*—for longer life under severe conditions. Made to A.P.I. specifications from highly specialized cold-drawn tubing. All standard sizes—with smooth, bright bore or chromium-plated bore. Oil-field distributors carry Hough products in stock. The Charles N. Hough Mfg. Company, Franklin, Pa.

Hough SEAMLESS STEEL Working Barrels

S. S. "PETE" PARKER

S. S. Parker to Dallas for National Tank

S. S. "Pete" Parker, formerly connected with the Hydril Company at Houston, Texas, in the capacity of vice-president and general manager, will be stationed at Dallas, Texas, in full charge of sales and service for the National Tank Company covering the territory from Louisiana to New Mexico. He will open an office in Dallas.

J. C. Slonneger Now with Continental Supply

Following a successful engineering career that began with Caterpillar Tractor Company a quarter of a century ago, J. C. Slonneger was appointed on April 1st to the position of assistant chief engineer of the Continental Supply Company, Dallas, Texas.

J. C. SLONNEGER

Slonneger comes to Continental from Falk Corporation, Milwaukee, Wisconsin, where he has served for six years as supervisor of engineering in the field throughout the Mid-Continent, Rocky Mountain, and California areas. For seven years prior to his association with Falk, Slonneger headed the research engineering department of International Harvester Company, Milwaukee, Wisconsin.

Slonneger's acquaintance among oil men throughout the country is wide in scope, both from a personal and technical standpoint. As the author of many technical articles and engineering papers published in numerous trade journals, his name is familiar to many throughout engineering circles. He also has a number of industrial inventions to his credit, among which the Emsco-Slonneger Type Counterbalance for oil field pumping units is the most widely known.

L. D. Murray with American Iron; Company Opens New Warehouses

Announcement of L. D. (Jiggs) Murray as sales representative of the Houston, Texas, territory for the American Iron and Machine Works Company has just been made by officials of that organization. Murray, formerly connected with the Amerada Petroleum Corporation, Bovaird Supply Company, and the Haynes Drilling Corporation, will make his headquarters at the Houston branch.

Just completed and opened for service is the new, modern machine shop and warehouse of the company at Monahans, Texas. The Monahans' branch is another addition that recently has been opened by American as a means of greatly facilitating service throughout the surrounding area served by these new locations. M. G. McCool, for two years representative in West Texas and New Mexico for the company, will be in charge of the new Monahans branch.

A new shop and warehouse also has been opened by the company at New Iberia, Louisiana.

Death of Professor Elihu Thomson

ELIHU THOMSON

Professor Elihu Thomson, 83, and one of the founders of the General Electric Company, died at his home in Swampscott, Massachusetts, March 13. He had been seriously ill since January. Professor Thomson, together with Thomas A. Edison, James J. Wood, and Charles F. Brush were the great quartet that created the modern electrical industry. Funeral services were conducted in Lynn, Massachusetts.

E. W. Brockman Joins Sales Force Rector Well Equipment Company

E. W. BROCKMAN

E. W. Brockman, a graduate in geology at Oklahoma University in 1934 and a member of the field staff of Petty Geophysical Engineering Corporation for the last two years, has joined the sales force of Rector Well Equipment Company, effective April 1st. Brockman spent his first week working with C. L. Cron, district manager in the Gulf Coast territory, prior to going to West Texas and New Mexico to travel that territory with W. P. "Red" Knight of the Rector organization. Upon completion of field trips through several active districts with sales representatives Brockman will make his headquarters at 310 Thompson Building, Tulsa, Oklahoma, and will cover the Oklahoma-Kansas division for the company.

Walter B. Gray Passes Away

WALTER GRAY

Walter B. Gray, manager in Tulsa, Oklahoma, for the Jarecki Manufacturing Company, died March 28 from pneumonia and influenza. Death occurred at Shreveport, Louisiana, at the home of his brother, Warren G. Gray, where he had gone to recuperate.

Gray was widely and favorably known in the petroleum industry. He was born at Bradford, Pennsylvania, April 13, 1881, and had been with the Jarecki organization for a great many years.

Continental Men to Be Honored

W. G. LUECK

A. E. CROUSE

A. E. Crouse and W. J. Lueck, employees at Continental Oil Company's Basile, Louisiana, gasoline plant, soon will be honored by the National Safety Council for saving the life of a woman who was overcome by gas. Crouse will receive the President's Medal of the National Safety Council, and Lueck will be given the Certificate for Valuable Assistance.

Brings You Natural Gas Economy ...PLUS Better Engine Performance

Where natural gas is available for fuel, worthwhile savings in fuel costs for stationary engines can be made with this widely used Ensign carburetor . . . not only in operating on natural gas, but in more efficient utilization of gasoline. Combining all the superior features of Ensign gas and gasoline carburetor design, this unit also assures more efficient operation on either fuel. Built simple and rugged, the Ensign Combination carburetor is ideal for oil field service. Adaptable to, and easily installed on all multi-cylinder stationary engines. Bulletin 84 gives a complete description.

Butane Equipment; Gasoline Carburetors for Industrial Engines and Tractors

ENSIGN CARBURETOR COMPANY, LTD.

HUNTINGTON PARK, CALIFORNIA

Chicago Branch: 2644 So. Michigan Avenue. Distributors with Stocks: A. W. Schuller, Inc., Tulsa, Okla.; The Binkley Co., Oklahoma City, Okla.; Portable Rig Co., Houston, Texas; H. G. Makelim, Oakland, California; T-V Supply Company, Wichita, Kansas.

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of THE PETROLEUM ENGINEER as a means for keeping posted on what other oil men are accomplishing and developing in operating methods and mechanical equipment, gives you the advantage of exclusive information—and at an economical cost.

To avoid missing an issue, renew your subscription promptly upon expiration.

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Wherever oil is produced from pumping wells the

B-M-W
ADMORE LINER BARREL

is a favorite

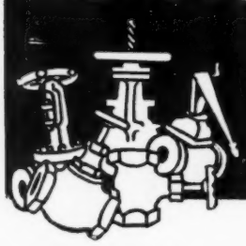
It is an inverted type insert pump. Seats in the top of a common working barrel or in a special seating nipple in the tubing. Can be used to pump from any level in the tubing when used in connection with the B-M-W Admore Insert Pump Anchor.

Inexpensive. Installed without the necessity of pulling tubing. The plunger is stationary. Outside tube reciprocates. Prevents accumulation of sand. Recommended for any depth to 6500 feet.

Principal B-M-W Products are obtainable at supply stores, including: • ADMORE Insert Pump Achors; • NEILSON TOOLS (Safety Sucker Rod Hooks, Tubing Hooks, Rod Elevators, Sucker Rod Sockets, etc.); • BALLS and SEATS (made for every pumping service); • ADMORE Liner Barrels; • TEX TYPE Plunger Fittings and Valves; and • COLLINS Belt Clamps.

BRADFORD MOTOR WORKS INC.
OIL WELL SUPPLIES
BRADFORD, PA. — TULSA, OKLA.

Don't junk
DIRTY VALVES



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Brochure on Arc Welding Prize Contest Available

The James F. Lincoln Arc Welding Foundation now has ready for distribution its prize contest brochure, containing the rules and conditions governing the $200,000 contest, and defining each industry classification in its contest application. The brochure also lists typical machines, structures, buildings, manufactured and fabricated products that contestants may select as subjects for papers. Some of the typical subjects are illustrated.

On page 39 is found sub-classification K-3, Industry Machinery: Petroleum. Any equipment designed for welding and built for use in the petroleum industry is a suitable subject for a paper. Papers in the K-3 sub-classification may share in the 54 prizes totaling $25,300 in the Industry Machinery classification. Such papers also may share in the four principal prizes of the contest totaling $26,000. A petroleum machinery paper also is eligible to win the grand prize of $13,700.

Copies of the brochure are being sent free to those interested. Write the James F. Lincoln Arc Welding Foundation, A. F. Davis, Secretary, P. O. Box 5728, Cleveland, Ohio.

Geo. S. Mepham Obtains Exclusive Use Sodium Hexametaphosphate for Control Drilling Muds

Geo. S. Mepham Corporation, of East St. Louis, Illinois, announced to the oil trade recently its purchase of the exclusive rights under the Feldenheimer United States Patent No. 1,438,588 for the use of sodium hexametaphosphate and other pyrogenic derivatives of ortho-phosphoric acid to control the deflocculation of clays in oil well drilling muds. The addition of a small amount of sodium hexametaphosphate to a drilling mud that has become too viscous will quickly reduce the viscosity of the mud and bring it readily under control, it is stated.

The use of the process of the Feldenheimer patent for deflocculating clays for ceramic and oil well drilling purposes extends back several years and the patent has received wide recognition for the production of deflocculated clays for ceramic purposes.

Ben F. Kelley Joins Shaffer Specialty Co.

Ben F. Kelley, widely experienced equipment salesman, has left Titusville Iron Works after 17 years service to become vice-president and sales manager of Shaffer Specialty Company of Tulsa, Oklahoma, in which concern he has become financially interested.

BEN F. KELLEY

Prior to his connection with Titusville Iron Works, Kelley was for nine years machinery salesman for the Continental Supply Company, having joined the latter concern in 1911 after two years in the production department of the Gypsy Oil Company. He came to Tulsa in 1909 following seven years in the oil industry at Hartford City, Indiana, his birthplace. The Shaffer Specialty Company are pioneer manufacturers of portable rotary and cable tool drilling units, rotary hose couplings, and a general line of oil field specialties. The company was founded in 1918 by Ernest J. and George W. Shaffer, president, and secretary-treasurer-general manager of the firm.

Link-Belt Elects Directors

At the annual meeting of stockholders of Link-Belt Company, held in Chicago, March 23, four directors were elected to serve until 1941. The newly-elected directors, Bernard E. Sunny, Chicago, and James S. Watson, Indianapolis, succeed Arthur L. Livermore, deceased, and Austin L. Adams, resigned. The re-elected directors are Staunton B. Peck, Chestnut Hill, Pennsylvania, and Harris Whittemore, Jr., Naugatuck, Connecticut.

Sunny is a director of a great many companies, among which are the General Electric Company, Illinois Bell Telephone Company, Public Service Company of Northern Illinois, Wilson & Company, Chicago Surface Lines, and the First National Bank, Chicago.

Watson is vice-president in charge of Indianapolis plant operations of Link-Belt Company, having served the company continuously for 44 years.

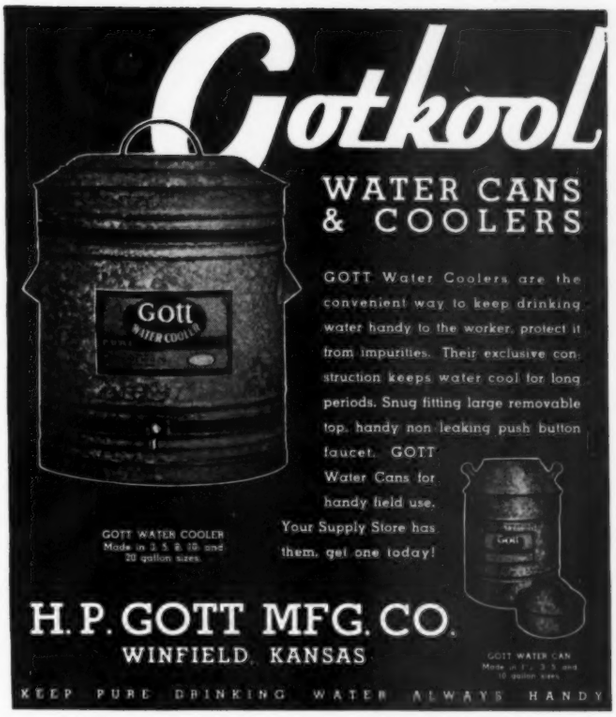
George W. "Jack" Walton Elected to Board of Emsco

George W. "Jack" Walton, recently transferred from the Dallas office to the home office of the Emsco Derrick and Equipment Company in Los Angeles, California, has been elected to the board of directors of the company. He will continue as sales manager, Mid-Continent Machinery Division, and will work with the engineering department on new developments, particularly those pertaining to the Mid-Continent, spending a portion of his time in the Los Angeles office and the rest in the various Mid-Continent fields.

GEORGE W. "JACK" WALTON

Walton Joined Emsco ten years ago as district manager of the Machinery and Derrick Division, being stationed in Tulsa, Oklahoma. After four years in Tulsa he was transferred to the Dallas office of the company, where he remained until his recent move. He has had a wide experience in both domestic and foreign fields.

During the World War he served with the air service and after being discharged joined the staff of Aiken, Curtis and Cosdon, remaining with them until the company was sold to the Transcontinental Oil Company, at which time he was made purchasing agent for the southern division of the new company. In 1919 he went with the National Supply Company, spending part of the time as export salesman, operating out of London, England, and covering the oil fields of Europe. In 1924, Walton left the National Supply Company to join the Wilson-Snyder Company and it was through his connection that Wilson-Snyder began the manufacture of slush pumps and other oil field products. In 1927 he resigned from Wilson-Snyder and joined the Emsco organization.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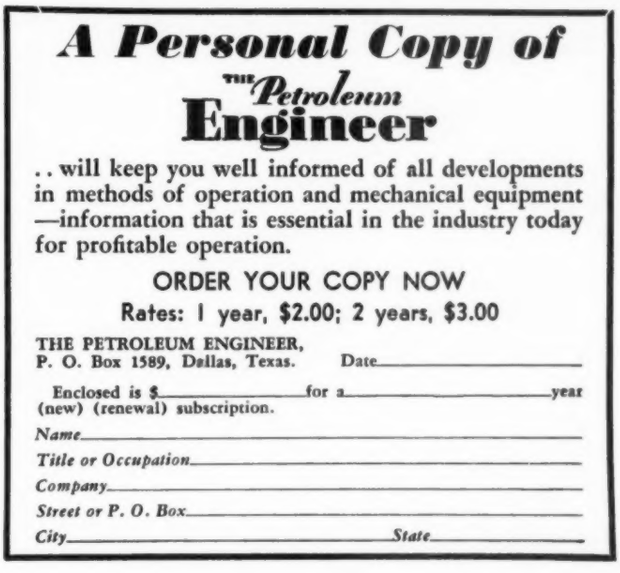
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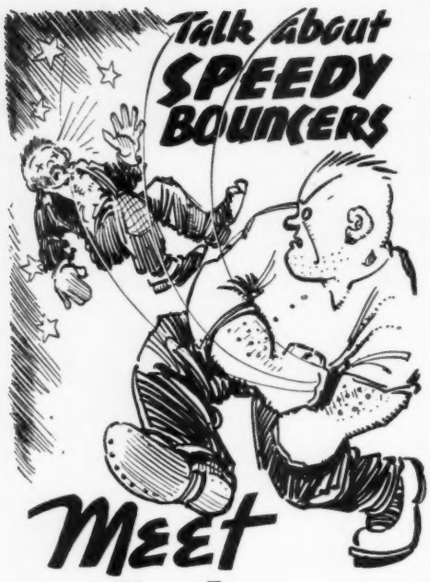

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